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ABSTRACT

This study identified the demographic and attitudinal characteristics of student and teacher audiences to provide background information for the development of the General Mathematics Instructional Television Series for the ninth and tenth grades, a series intended to promote increased awareness of applications of mathematics in everyday life and to facilitate student awareness that mathematics is useful, important, and relevant to their lives. Information on the levels of student attitude toward mathematics and their awareness of applications was considered essential to appropriately targeting program content; reactions of teachers were considered important to the development of both programs and related print materials. Following a brief description of the study methodology, the demographic characteristics of teachers and classes in sample sites in Alberta, Arkansas, Florida, Nebraska, Utah, and Vermont are summarized. Additional sections describe information gathered for instructional design purposes. A six-item reference list and teacher and student questionnaires are included. (LMM)

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Research Report 80

Secondary General Mathematics: Attitudinal and Demographic Characteristics of Teachers and Students

September 1980

Agency for Instructional Television
Box A
Bloomington, Indiana 47402

IR011411

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Of obvious, but special importance, are the 41 teachers and 773 general mathematics students who shared their reactions.

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Brenda Jochums
Research Associate

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Summary of Results of Audience Research

The AIT Secondary School Television Project includes a general mathematics series for ninth and tenth grades. The twelve program series with related print materials will be available for use in the fall of 1981.

Goals of classroom use are to promote increased awareness of applications of mathematics in everyday life and to facilitate student awareness that mathematics is useful, important, and relevant to their lives.

This research answers the question: What are the demographic and attitudinal characteristics of teacher and student audiences? Knowing levels of student attitude towards mathematics and their awareness of applications was considered essential to appropriately targeting program content. Reactions of teachers were considered important to the development of both programs and related print materials.

This background research was conducted in the first half of 1980. Data were reactions of teachers and students from the sample set up for formative evaluation activities. Five widespread geographical sites included five states and one Canadian province.

General Mathematics Teacher Audience

* General Mathematics teachers have a wide range of years of work experience.

Overall Teaching Experience	Average:	11.4 years
	Range:	1 to 29 years
Teaching General Math	Average:	7.9 years
	Range:	1 to 25 years

* The majority of general math teachers are male.

  34% Female
  66% Male

* Most teachers have taught in more than one community setting.

  49% in rural schools
  56% in suburban schools
  34% in urban, inner-city schools
  20% in other urban schools

* Most of the sample had academic training in math education. Of those majoring in mathematics, the sex ratio followed the total sample proportions.

  81% majored in mathematics
  One third were females; two thirds were male

* Use of ITV is modest but exceeds national statistics.

  25% of the General Mathematics teachers reported occasional use in contrast to 7-14% reported in 1979 NAEP reports.

  Although 3/4 of the teachers have equipment available to them, reasons for lack of use included lack of programs, lack of acceptable programs, inconvenience of scheduling equipment or other logistics, and lack of time.

* General Mathematics teachers have multiple interpretations of the term "problem solving."

  "Problem Solving" to some is the completion of word problems on work sheets.

  "Problem Solving" was interpreted as use of a discovery method or following steps of problem analysis.

  "Problem Solving" was related to heuristics, e.g., estimating, establishing, patterns, recognition and generalization. trial and error, use of similar problems.

* Applications of mathematics now in use by teachers focus on consumer topics with few exceptions.

General Mathematics Student Audience

For this formative evaluation sample, ninth and tenth grade classes were requested with the caveat that classes should be representative of the consortium agency's general mathematics student population.

* The sample of 38 sections included 8th through 12th graders. 43% of the 773 students were female and 57% were male.

* 45% of the sections were ninth grade classes.

* 34% of the sections were split grades.

* 16% of the sample were minority students.

* The class sections were drawn primarily from suburban and rural community settings.

36%	Rural
33%	Suburban
14%	Inner-city
17%	Other Urban

* Socioeconomic level of classes was judged to be:

24%	Lower SES
54%	Lower Middle
14%	Middle SES
6%	Upper Middle
3%	Upper SES

* Ability level of classes was judged to be:

53%	Below Average
41%	Average
6%	Above Average

Attitude Responses By Teachers

Individual items were developed to focus on 3 areas:

preparation for, and teaching of, general mathematics,

use of supplementary materials, and

perception of general mathematics students

* Preparation for teaching general mathematics

  55% endorsed the idea that general math instructors are well prepared academically.

  59% agreed that teachers are well prepared to teach computational skills.

* The group was divided on the ease, or difficulty, of teaching real-life applications.

* Competency testing issues do not override teacher interest in the goals of the General Mathematics series.

  Teachers, as a group, were undecided about competencies as a major focus for the general math curriculum.

  ITV should not be selected to repeat skills and computations.

* Teachers endorse series goals--ITV, and other supplementary materials, have a special function in the General Math classroom.

  Teachers overwhelmingly would like to have materials showing applications of math to everyday life.

  AV materials should parallel, but go beyond, texts and add new ideas to the curriculum.

  ITV programs should not be selected primarily to repeat skills and computations on which the class must be tested.

  ITV should be selected as a means to motivate students.

* Teachers have mixed reactions to student capability and competencies but agree strongly that student attitude change is necessary for success.

* Demonstrating the value of math was seen as a means to needed attitude change in students.

Student Attitude Towards Mathematics

A Likert scale was developed, assuming a broad definition of attitude towards mathematics. Analyses included demographic comparisons of overall attitude and examination of individual items.

* For the ninth and tenth grade target-audience, significant grade and sex differences occurred in attitude towards mathematics.

  Ninth graders were more positive than their tenth grade counterparts.

  Females were more positive in their attitudes than males.

* In addition to sex differences on overall attitude, females differed from males on a number of interesting statements.

  Females responded with significantly more interest in math texts, in doing well, getting a good math grade, working hard, and feeling good when solving problems by themselves.

  Females also differed significantly in feeling less capable, more reluctant to ask questions, and in seeing math as hard work (and no fun).

* Ninth graders agreed significantly more often than tenth graders with wanting to do well in math and knowing that their parents want them to do well.

* Ninth graders were significantly more optimistic about understanding mathematics; they rated math as more enjoyable than did tenth graders.

* As a total group, students had little enthusiasm for math-related jobs, even though knowing arithmetic was acknowledged to be important vocationally.

* As a total group, students did not respond positively to statements about math as a subject or math class.

* Three demographic variables (community type, socioeconomic level, and ability level of the class) failed to predict significant differences in student attitude.

Awareness of Application of Math Activities

Students were asked to rate how often they might use, or apply mathematical activities. Analyses included demographic comparisons of overall awareness and examination of individual items.

* Awareness of applications of math activities differ significantly among socioeconomic levels and community types.

* Awareness did not differ when sex of student, grade level, or teacher judgments of overall class ability were used.

* Urban classes judged to be of lower SES level responded with significantly lower awareness than did suburban classes judged to be of middle or upper SES levels.

* Math activities rated as often encountered:

estimating measurements
checking answers by going over a problem
follow a map
working with measurements
work with decimals
memorize rules and formulas

* Math activities rated as seldom encountered:

make a table of members
make a map
make a scale model
write a ratio as a decimal or percent
use formulas to solve measurement problems
describe a relationship by using a ratio

The background research results revealed an experienced, receptive teacher audience who welcome supplementary materials. Indications are that they sense a special place in their view of the general mathematics curriculum for quality ITV materials which demonstrate applications and foster attitude change. The complexity of their view of students is evident, but a commonly held view is that attitude change in students will facilitate success.

General mathematics classes include a wide variety of grade levels, but, for this sample, ninth grade is the most common level. The General Mathematics Project will be challenged to meet multi-faceted needs of the student audience. Challenging complexities are evident in both attitude towards mathematics and awareness of the application of math activities.

INTRODUCTION

The secondary School Television Project, launched by the Agency for Instructional Television in 1979, includes as one component a television series for use in ninth and tenth grade general mathematics classes. The development of the General Mathematics Series is guided and supported by a consortium of educational agencies with additional support from Shell Oil and the Exxon Foundation. The twelve-program series with related print materials will be available for use in the fall of 1981.

The goals of classroom use of the series are to promote increased awareness of applications of mathematics in everyday life and to facilitate the awareness that mathematics is useful, important, and relevant. Mathematics applications will be demonstrated in the programs; underlying the demonstrations is a three-dimensional model incorporating mathematics processes (e.g., predicting), mathematics content topics (e.g., ratios), and problem-solving techniques (e.g., making a table).

In the process of developing an instructional design and evaluation plan for the series, the design team recognized and defined its need for information about the student and teacher audiences. Knowing the levels of student attitude toward mathematics and their awareness of applications was considered essential to appropriately targeting the program content. Specific reactions of teachers were considered important to the development of both programs and the related print materials.

The purpose of this report is to summarize audience characteristics thought to be particularly relevant to the General Mathematics Series. This background research was conducted during the first six months of 1980.

Data were responses of teachers and students who constituted the sample available for later formative evaluation activities. The following paragraphs provide a brief description of how and why the evaluation sample was set up.

Research efforts were specifically and deliberately aimed at providing essential information in as simple and direct a manner as possible. A search for available documents provided information about secondary general mathematics curricular materials, curricular guidelines established by states or provinces, and reports of a national scope (National Assesment of Educational Progress, 1979). The information from these documents supplemented and further focused the project's information needs.

The evaluation plan for the project (see Secondary Mathematics Series Consortium Report No. 2, February 1, 1980, pp. 2, 13-15) called for the identification of several sites represented by consortium agencies. Contact with those sites was to be maintained throughout the life of the project or so long as the working relationship remained satisfactory to consortium agencies, the school districts, teachers, students involved, and to AIT's research needs. The commitment to serving in such a capacity was agreed upon in advance by the consortium representatives. Local schools and/or school district approvals were also sought in advance.

The request to serve as a research and evaluation site was made of six consortium states and provinces: Alberta, Arkansas, Florida, Nebraska, Utah, and Vermont. They were selected because they are well-distributed geographically and because of their early commitment and active interest in development of the General Mathematics Series. Even though other agencies were committed and active, the number was limited to six; a larger number was considered likely to become too cumbersome for a single staff member to coordinate well.

To function smoothly and provide sufficient numbers of classes for data collection, each consortium agency involved was asked to contact 5 to 7 teachers. Selected teachers were to know that the secondary mathematics research would be on-going for 1 1/2 years. Estimates of time involvement and frequency of involvement of both teachers and students were provided. The evaluation plan was developed on the assumption that a pool of about 30 teachers would be desirable. A minimum of 25 teachers, with a margin for attrition during the summer months, was considered necessary to provide sufficient number of classes throughout the project.

To assure a representative pool of students from which to draw samples for data collections, each of the agencies was asked to locate teachers of classes that were representative of the state or province and, hence, the presumed audience of the General Mathematics Series in that geographic area. For example, the series is aimed at ninth and tenth grade, but those grades may be located in junior high, middle, or senior high schools. The local consortium agency was to determine the best combination of schools, teachers, and classes to represent a natural cross section of general mathematics classes.

Several characteristics were requested in addition. The sample needed to contain both female and male students representing various demographic groups. The range of communities should provide rural, suburban, and urban schools with a variety of socioeconomic circumstances. Ethnic minority groups should be represented.

The next two sections of the report summarize selected demographic characteristics of the teachers and classes included in the sample of sites. The information was reported by teachers during meetings that oriented them to the project and to their role in research activities. The last two sections of the report describe information gathered for instructional design purposes. Attitudinal responses of teachers toward specific aspects of

teaching general mathematics and toward the use of audiovisual supplements were gathered to guide the development of print materials for teachers. Background information about student attitudes and awareness of applications was collected to focus program content appropriately.

DEMOGRAPHIC CHARACTERISTICS OF TEACHERS

The following section summarizes demographic and background characteristics of the teachers in the formative evaluation sample. These teachers comprise the first and most immediate teacher audience for the General Mathematics materials. How closely they match a random sample of general mathematics teachers is impossible to determine precisely, but, where appropriate, comparisons with national studies are provided in the text.

The issues of interest were developed by the design team as a whole. Questions arose as to the predominance of males as math teachers, the possibility of nonmathematics majors teaching general mathematics, and use of ITV. A further concern was to get some reactions to "problem-solving" as a theme in the teaching of general mathematics, particularly since it constitutes one dimension of the instructional design model.

Method

A teacher information questionnaire was completed by teachers at the teacher orientation meetings held in February, March, and April, 1980. The issues mentioned above were addressed in Teacher Information Questionnaire A (see Appendix A).

Profile of Teacher Sample

Teachers from the province of Alberta and five states (Arkansas, Florida, Vermont, Nebraska and Utah) comprised the General Mathematics Series teacher sample. Table 1 summarizes the number, sex, and average work experience of the teachers grouped by location. The range of teaching experience was from 1 to 29 years, with the experience of teaching general mathematics from 1 to 25 years.

TABLE 1

Demographic characteristics of teacher sample

Location	N	Male	Female	Average years as Teacher	Ave. yrs. teaching General Math
Alberta	7	6	1	10.9	7.0
Arkansas	7	4	3	10.1	7.7
Florida	7	3	4	10.0	8.7
Vermont	6	4	2	12.2	9.7
Nebraska	7	5	2	10.6	6.9
Utah	7	5	2	14.7	7.1
Total (or average)	41	27	14	11.4	7.9

Teachers were asked to check the community settings in which they had taught. All four categories (Rural; Suburban; Urban, Inner-city; and Urban, other) were represented in the sample's experience (see Table 2). Teachers frequently have taught in more than one setting.

TABLE 2

Number of teachers reporting experience in each community setting*

Setting	N	%
Rural	20	48.8
Suburban	23	56.1
Urban, Inner-city	14	34.1
Urban, Other	5	19.5

* Percentages exceed 100% because many of the 41 teachers have taught in multiple community settings.

The content area most often reported as a major in conjunction with secondary education was mathematics. Thirty-three (80.5%) of the teachers majored in mathematics; of the 33, 11 (26.8%) are females and 22 (53.7%) are males. Each of the following majors was reported: physics, chemistry, business administration, science, vocational education, history and economics. In no case did more than one teacher report any of the above, except physics (N=2).

The National Survey of Science, Mathematics and Social Studies Education (Weiss, 1978) reported little use of televised instruction by mathematics teachers; 87% reported "never" using ITV. In the National Survey sample, those using ITV reported infrequent use; the report indicated very little variation among grade levels.

As a comparison to the National Survey sample, queries were made of the General Mathematics teacher sample about their experience with instructional television (ITV) and other supplements beyond the chalk and chalkboard. Twenty-two teachers (53.7%) reported never having had any introduction to ITV for secondary schools. Only nine (22%) reported exposure to ITV in a methods class.

With respect to present use of ITV, ten (24.4%) teachers reported occasional use (once a month or irregularly). Fifty-nine percent (N=24) acknowledged that they never use ITV. Reasons cited included the following: lack of programs, lack of acceptable programs, inconvenience (equipment or other logistics), lack of time (a sense that just surviving in the classroom situation takes every moment and does not allow for integrating ITV.) Three-fourths of the teachers (N=31; 75.6%) responded that television equipment is available, even though several remarked about the difficulty in scheduling or obtaining the equipment. The 1980 General Mathematics sample reported more frequent use of ITV than did the National Survey sample in

1977. While 24.4% of the General Mathematics teachers reported use "once a month or irregularly," only 7 to 14% of the National Survey sample had reported use of any form of television.

Table 3 lists other supplements to classroom text material mentioned by the General Mathematics teacher sample as already in use in their general mathematics instruction. Three of the supplements (overhead projector, film, and filmstrips) were listed by a greater percentage of teachers than the percentage who reported occasional use of ITV (24.4%). While the frequency of use by a given teacher cannot be compared, these data are suggestive of the way ITV ranks with other supplemental materials for this sample.

TABLE 3

Number and percentage of teachers reporting use of supplemental materials*

	N	%
Overhead projector	20	48.8
Film	14	34.1
Filmstrips	11	26.8
Models/Constructions	5	12.2
Tape cassettes	3	7.3
Newspapers/Magazines	3	7.3
Demonstrations	3	7.3
Slides	2	4.9
Charts	2	4.9
Mini computers/calculators	2	4.9
Printed masters	1	2.4
None used	5	12.2

*Several teachers listed more than one supplemental material. Consequently, total percentage is greater than 100%.

While the General Mathematics teachers were asked to list the supplements they use, the National Survey had provided a checklist focused on major audiovisual (AV) media. Of the comparable categories, the rank orders of use were similar, with ITV as the exception. The overhead projector, film, filmstrips were fairly often endorsed by both groups. ITV, tapes, and slides followed in that order for the General Mathematics sample. In the National Survey, tapes were used more often than slides or ITV.

Because problem-solving is a current theme in mathematics education, open-ended questions were asked about the approach to problem-solving used by the teachers. Examples of integrating problem-solving into the curriculum were requested.

Responses indicated various interpretations of the term "problem-solving." One interpretation related problem-solving to the assignment of word problems on work sheets; some teachers gave examples of using written application in terms of focusing word problems on income-tax, banking, shopping and consumer information, and sports statistics. Teachers reported that problem-solving involving distances is studied by means of maps and charts.

A second interpretation of problem-solving focused on the instructional methods used. For example, one teacher cited the discovery method; another provided the following steps of problem analysis:

1. What do you know?
2. What do you need?
3. How can you find this?
4. Have you seen a similar problem?
5. How can we apply this idea?

Heursitics were mentioned by several teachers. Included were estimating, establishing patterns, recognition and generalization, trial and error, and similar problems. The use of similar problems was fairly often mentioned. In several cases, teachers reported demonstrating with a given

problem, then asking students to solve similar problems. In only a few cases, as in the problem analysis outlined above, did teachers imply that students think about similar problem to the one at hand.

Several application topics were included in comments. They are listed in Table 4.

TABLE 4

Application Topics in Use by Teachers

1.	Motion
2.	Interest, loans, mortgages
3.	Personal banking, checking, statements
4.	Income tax
5.	Mixtures & solutions (agri-business, science, gasohol)
6.	Purchase of a vehicle
7.	Insurance
8.	Percentages on graphs, research
9.	Salaries, wages, deductions
10.	Buying at discount, sales tax
11.	Areas -- classrooms, students' room
12.	Commission on sales
13.	Compound interest
14.	Distances -- tools, charts, graphs
15.	Sports statistics
16.	Home construction

Summary

The teachers represented a wide geographic range as well as substantial experience in teaching general mathematics. The sample included both fairly inexperienced and very experienced educators. The idea that general math classes are given to new teachers who then move away from general math as they gain experience is not supported by the characteristics of this sample. However, males did outnumber females almost two to one, supporting the view

that males predominate as secondary mathematics teachers.

Another concern was the frequency of non-math majors teaching general mathematics. In this sample, over three-fourths of the teachers have had mathematics education backgrounds.

As was expected, little use of ITV was reported by the teachers in the sample. Use of other supplemental materials was, however, reported and suggests hope for integrating an ITV series if logistical problems can be circumvented.

"Problem-solving" was not viewed in a unitary manner by the group. A few comments suggested an understanding congruent with present educational theory, but many teachers did not seem prepared to teach problem-solving in the way discussed in the design team meetings. Some misconceptions or colloquial usages were evident in teacher comments. Consequently, the project might have to address this issue in a direct way. We might plan to develop the teacher guide or the role of the host to facilitate communication to teachers as well as students. Intertwined with a more colloquial version of problem-solving was an evident priority on the teachers' parts for showing applications. The applications they cited as ones they use at present were primarily consumer issues. Two opportunities are again confirmed for the series -- (1) to touch some currently used applications in a creative way and (2) to extend the range of applications beyond that allowed by present supplemental materials.

CLASSROOM INFORMATION REPORT

Setting up a mechanism by which contact with classrooms can be continued across the design and production phases of a project allows for assessing the demographic characteristics of the student pool before using it in formative evaluation activities. Following is a profile of classes cooperating in the series development. Classroom samples can be drawn randomly or selected for specific needs.

Method

The data reported here were based on the sections of general mathematics taught by teachers who attended the teacher orientation meetings in February, 1980. Teachers completed classroom information cards for each section that would participate in the research and evaluation activities (see Questionnaire B, Appendix A). Five of the six original sites were included in the sample, (Arkansas, Alberta, Florida, Nebraska, Vermont). These 1979-80 general mathematics students participated in baseline research activities and some script evaluation. In the fall of 1980, teachers will provide new demographic information on the 1980-81 general mathematics classes.

Results

The distribution of classes across grade levels is provided in Table 5. Almost 45% of the sample were ninth-grade classes. Thirty-four percent were split grades. No eleventh-grade classes were included.

TABLE 5

Grade Levels Represented in the General Mathematics Sample

Grade	Number of Sections	%
8	2	5.26
9	17	44.73
10	5	13.16
11	--	0.00
12	1	2.63
Split 9-10	7	18.42
Split 9-10-11	3	7.89
Split 10-11	2	5.26
Split 8-12	1	2.63
TOTAL	38	100.0

The sex of students by grade level is represented in Table 6. All percentages were computed on the total sample size of 773 students. Males outnumbered females somewhat in the total sample, but the differential was greatest among ninth graders. With respect to the total sample, 43% (N= 333) were female and about 57% (N= 440) were male.

TABLE 6

Number and Sex of Students by Grade Level in General Math Sample*

Grade	Female	%	Male	%	Total	%
8	25	7.50	21	2.71	46	5.95
9	152	45.65	210	47.73	362	46.83
10	47	14.11	48	10.90	95	12.29
11	--	0.00	--	0.00	--	0.00
12	12	3.60	15	3.41	27	3.49
9-10	37	11.11	81	18.40	118	15.27
9-10-11	37	11.11	33	7.50	70	9.06
10-11	15	4.50	24	5.45	39	5.05
8-12	8	2.40	8	1.81	16	2.07
TOTAL	333	43.08	440	56.92	773	100.0

*Percentages are computed on the total sample of 773 students.

Teachers provided a breakdown of ethnic group membership in their present classes. Table 7 indicates the frequency and percentages of minority group and non-minority students by grade level.

TABLE 7

Representation of Minority and Non-minority Group Students in the General Mathematics* Sample

Grade	Minority Students		Non-minority Students		Total Sample	
	N	%	N	%	N	%
8	1	0.13	45	5.86	46	5.99
9	71	9.24	291	37.89	362	47.14
10	27	3.52	67	8.72	94	12.24
12	12	1.56	15	1.95	27	3.52
9-10	1	0.13	101	13.15	102	13.28
9-10-11	0	0.00	70	9.11	70	9.11
10-11	8	1.04	43	5.60	51	6.64
8-12	6	0.78	10	1.30	16	2.08
TOTAL	126	16.41	642	83.59	768	100.0

*Missing data = 5 cases.

The percentage of minority students was modest for the total sample (16.41%). An ethnic group breakdown reveals that of the minority students, 93 (74.81%) were black. Hispanics (N=16) comprised 12.70% of the minority group; and Asian students, who numbered 11, represented 8.73% of the minority sub-sample. Five Native American/Native Canadian students, and one French-Canadian student completed the minority group representatives.

Teachers were also asked to judge the type of community environment represented by each general mathematics section. Obviously, this was a gross estimate, but Table 8 reveals that almost 70% of the sections were rural or suburban and only about 30% were urban.

TABLE 8

Number of Classes of Each Community Type*

Grade	Rural	%	Suburban	%	Urban, Inner-City	%	Urban, Other	%	Total	%
8	2	5.56	--		--		--		2	5.56
9	4	11.11	4	11.11	2	5.56	6	16.67	16	44.44
10	3	8.33	2	5.56	--		--		5	13.89
11	--		--		--		--		--	
12	--		1	2.78	--		--		1	2.78
9-10	2	5.56	2	5.56	3	8.33	--		7	19.44
9-10-11	2	5.56	1	2.78	--		--		3	8.33
10-11	--		2	5.56	--		--		2	5.56
TOTAL*	13	36.11	12	33.33	5	13.89	6	16.67	36	100.0

*Two sections had no community type reported; one of them represents an alternative school and draws youngsters from many areas.

This disproportional representation of urban classes and minority students necessitates changes in the 1980-81 sample. Preliminary contacts have been made for adding teachers and classes that include a greater proportion of minority and urban students.

Teacher estimates of the overall socioeconomic level of classes suggested that the sample was skewed in a lower or lower-middle class direction with middle and upper socioeconomic strata being underrepresented. The lower SES group was represented by 24.32% of the 37 sections reported (N= 9). Fifty-four per-

cent were judged to represent the lower-middle SES level. Five middle SES sections (13.89%), two upper-middle (5.56%), and one upper SES section (2.78%) were reported.

Teachers were also asked to estimate the overall ability of the general mathematics sections. Estimates were reported on 34 of the sections. Eighteen sections (52.94%) were udged to be below average in ability. Student ability was estimated as average in 14 (41.18%) of the sections, and only two sections (5.88%) were judged to be above average in ability. About half the sections were reported to be homogeneously grouped in that student ability levels were perceived as similar.

Summary

The 1979-80 general mathematics classes represented all secondary grade levels except the eleventh. The largest numbers of classes were ninth grades, and the next largest group was of split grades. Males outnumbered females in this sample by 14 percentage points.

While the balance of grade levels and sex of students were not surprising for a general mathematics sample, other demographic characteristics were present in an atypical combination. Almost 70% of the classes were judged to be in suburban or rural settings, and 78% were estimated to be of lower middle or lower socioeconomic status. Urban and middle class students were underrepresented as well as all minority group students.

In anticipation of formative evaluation activities, an effort should be made to increase the numbers of urban and minority students.

TEACHER REACTIONS TO ATTITUDE ITEMS

Aware of the importance of the teacher audience to successful utilization, the General Mathematics design team requested information about the likely attitudes of teachers. Several issues had been raised regarding teacher reaction to specific aspects of teaching general mathematics, to the use of supplementary materials, and to the student population. Depending on teacher reactions, variations in the program content and print materials would be indicated. Clearly, only information from the teacher audience could confirm or deny specific concerns, raise flags, or identify areas of latitude to project developers.

Procedures

After questions were generated, a corresponding series of Likert items was developed. The five-point attitude items were phrased to focus on specific issues and were not intended to represent a cohesive, overall attitude toward teaching general mathematics. (See Teacher Information Questionnaire C, Appendix A.)

The attitude questionnaire was filled out by teachers attending orientation meetings for the research and evaluation activities of the project. Teachers varied in the degree of knowledge they had about the project. For example, in one state teachers were asked to fill out questionnaires prior to any detailed introduction to the project; they reacted with questions and some consternation, requesting more information. In later meetings, more information was provided prior to asking teachers to complete the forms.

The possible biasing effect of too much project information was accepted as a trade-off. Allowing for such bias avoided another possible bias, that introduced when respondents are angered or feel insecure because of too little information.

Sample

The teachers sampled were those who agreed to be involved in research and evaluation activities. An argument can be made for some aspects of representativeness of this group of 33 respondents. They represented five of the six evaluation sites: Alberta, Arkansas, Florida, Nebraska, and Vermont. Their collective teaching experiences occurred in all four community settings (rural; suburban; urban, high density; and urban, low density). They averaged 10.8 years of teaching experience, and an average of 8.0 years of teaching general mathematics.

Results

Prior to analyzing the data for the total group of 33 teachers, two analyses were done to ensure the uniformity of the sample. Teachers who had little project orientation prior to filling out the forms (Low Information) were compared to those who had more (High Information). Similarity of response patterns within the two groups was established for Low Information teachers, High Information teachers, and the total sample.[1] Cohesiveness, or similarity, within the groups allowed comparison between the groups.

Comparisons between the Low Information and High Information teachers were done for three clusters of items separately. In no case were differences statistically significant.[2] On that basis, possible biasing effects of infor-

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[1] Values for Kendall's coefficient of concordance were all highly significant.
Low Information Teachers: $W=.473$, $Chi^2=59.588$, $df=18$, $p=.000$.
High Information Teachers: $W=.395$, $Chi^2=180.708$, $df=18$, $p=.000$.
Total Group: $W=.376$, $Chi^2=189.708$, $df=18$, $p=.000$.

[2] Comparisons involved 2-sample median tests of the clustered responses for the three-item groups. Neither one- nor two-tailed exact probabilities were beyond the $p=.05$ level.

mation seem not to have affected teacher reactions to the attitude items, and the Low Information and High Information groups were combined for further data analysis.

As mentioned previously, the items were analyzed individually rather than as a scale. Treating the items as a scale would have assumed a common underlying attitude dimension, and assumption not warranted by, or desirable, in light of the information needed. Frequencies of response for each item were computed. Because of negative phrasing, a few items were recoded to allow a high value to indicate a positive attitude. Recoded items are specifically noted in the discussion below.

In addition, median values were computed to provide an appropriate measure of central tendency. The bimodal character of some item response distributions is noted in the text.

The data are displayed and summarized as three relatively discrete item clusters. First, issues of the preparation for teaching and the actual teaching of general math are presented (Items 2,6,8,12,15,16). Then, reactions to the function of supplementary and audiovisual materials are summarized (Items 3, 4, 7, 9, 13, 14, 19) Last, some indicators of the teachers' views of general math students are provided (Items 1, 5, 11, 16, 17, 18).[3]

Teaching General Mathematics. Three of the six items reproduced in Table 1 deal with how well-prepared teachers feel they and their colleagues are to teach either the course or specific aspects of the course. The sample was somewhat divided, but 55% endorsed the idea that general math instructors are well-prepared academically for teaching the course. They disagreed with

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[3] Item clusters are based on content, not a statistical clustering technique. Sample size, in relation to the number of items, is too small to justify use of factor analysis or other related techniques.

the statement that too many general math teachers are trained in another curriculum area.

With respect to specific aspects of teaching, 59% agreed that teachers are well-prepared to teach computational skills. More agreement was found for the view that teaching probability and statistical calculations is difficult. Incidental comments in the orientation meetings revealed that probability is a topic sometimes left until the end of the term or not taught at all. Because of the priorities given other topics or the need for remediating student skills, several teachers acknowledged little likelihood of their using the probability programs. Others thought brief exposure to the fundamental concepts would be helpful, but urged a simple, clear treatment in the programs. The group was also divided on the ease of teaching real-life applications; while 47% agreed or strongly agreed that application was easy to teach, 44% disagreed or strongly disagreed.

Some concern had been expressed in the early phase of project development that many teachers would be so focused on teaching basic skills that they might not be receptive to a series emphasizing positive attitudes toward math and awareness of applications. While 59% agreed that teachers are well-prepared to teach computational skills, the sample was more divided about whether competencies should be a major focus.

TABLE 9

Percentages of Teacher Response in Each Category to Items About Teaching and Preparation for General Mathematics

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
General math teachers are particularly well prepared for teaching computational skills. (N=32)	9	50	9	25	6
Too many general math instructors were trained in another curriculum area. (N=32)	13	19	25	38	6
General math instructors are well prepared academically for teaching the course. (N=29)	10	45	7	28	10
Teaching probability and statistical calculations is difficult. (N=29)	14	55	21	3	7
Real-life applications are the easiest part of teaching general math. (N=32)	9	38	9	25	19
Drill & practice on mathematical competancies should be the major focus of a general math curriculum. (N=29)	10	24	28	31	7

For all the items, the average (median) response is graphically depicted in Figure 1. The median value is that above and below which 50% of the sample falls. For example, the median of 2.9 suggests the clear division among teachers on the issue of competancies as a major general mathematics focus.

For the two items that are related fairly directly to the issue of competancy testing, responses were subjected to a secondary analysis. The sample was divided into competancy and no competancy testing groups. Two of the five states or provinces have established competancy testing procedures for general mathematics in the secondary schools. Item 2 ("General math teachers are particularly well-prepared for teaching computational skills") and Item 16 ("Drill and practice on mathematical competancies should be the major focus of a general math curriculum") tap different

facets of the issue. No significant differences were found on two-sample median tests between teachers representing states or provinces requiring competancy tests and teachers from locations not requiring general mathematics competancy tests.[4] Being from a state or province that requires competancy testing does not seem to move teachers to assert that drill and practice on competancies should be the curriculum focus.

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[4]For Item 2, the distribution of competancy and no competancy responses above and below the group median is similar for the two groups. N=32, Chi^2=.788, two-tailed probability=.375.

For Item 16, N=29, exact two-tailed probability=.788.

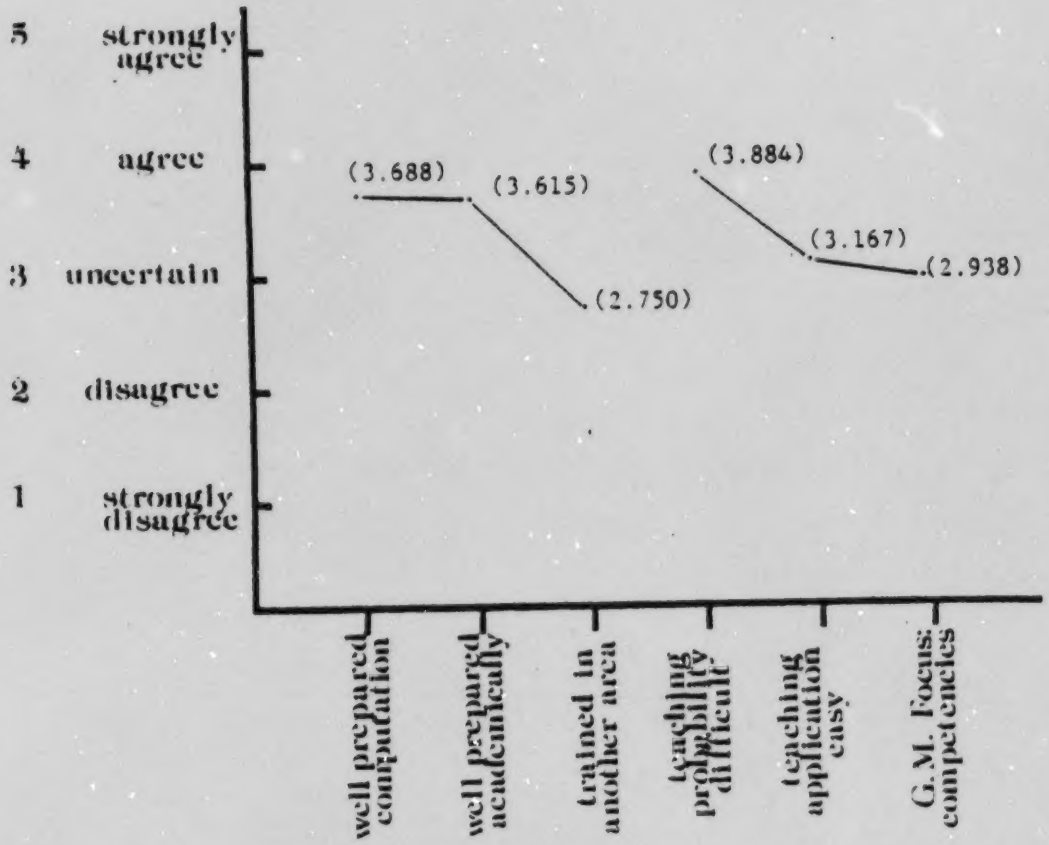

Figure 1. Median teacher response to items about teaching and preparation for general mathematics.

Function of Materials

The seven items and percentages of response to each alternative are given in Table 2. The responses suggest an expectation that, while audio-visual materials may parallel or relate to a course text, they should go beyond the text and add new ideas to a curriculum. Ninety-six percent of the teachers agreed that their motive for using ITV materials would be to motivate a new view of mathematics among students. They tended to disagree with the use of television to repeat skills and computational material.

TABLE 10

Percentages of Teacher Response to Items Relating to the Function of Materials for General Mathematics

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Audiovisual materials should treat the same material as in the course textbook. (N=33)	6	30	30	30	3
A primary reason for selecting television programs for in-class use would be to repeat skills and computations on which the class must be tested. (N=33)	3	12	15	64	6
Audiovisual materials should add new ideas to the curriculum beyond what is in a course textbook. (N=29)	21	69	3	3	3
Motivating students to see mathematics in a new way would be a primary motive for my selecting television materials for classroom use. (N=33)	55	42	3	0	0
Even if ITV programs were available, lack of equipment would preclude use.	7	31	14	24	24
I have almost no supplementary materials for teaching general mathematics. (N=31)	10	45	3	35	6
General math instructors would like supplementary materials which present applications of mathematical processes (like measuring, predicting, etc.) to real life situations. (N=29)	52	48	0	0	0

This sample's view was consistent with the design of the series; the series is intended to parallel the existing curriculum in the presentation of general mathematics processes but to go beyond typical text offerings in the area of demonstrating applications. These teachers strongly endorsed the idea that teachers would like supplementary materials focusing on applications of mathematical processes.

Figure 2 graphically displays the average (median) responses to each item. One item in Figure 2 is recoded to demonstrate visually the clustering of several items. Item 4 ("I have almost no supplementary materials for teaching general mathematics") is stated in a negative way. Agreement with the item suggests a lack of supplementary materials (Actual Median = 3.607). The recoding treats the item as if agreement suggests adequate supplementary materials (Recoded Median = 2.393). Teachers reacted in a manner suggesting that they have insufficient supplementary materials.

The median (3.050) for Item 7 ("Audiovisual materials should treat the same material as in the course textbook") reflects the variability of the sample's responses. No significant difference appeared when the sample was divided into competancy and no competancy testing subgroups. Teachers remained divided on the advisability of audiovisual materials paralleling a text.

More uniformity of response was apparent for Item 9 ("A primary reason for selecting television programs for in-class use would be to repeat skills and computations on which the class must be tested"); 70% of the respondents disagreed or strongly disagreed. A statistically significant difference, however, exists between teachers from competancy or no competancy testing

locations. Teachers from states or provinces requiring competancy testing were about equally divided on the selection of ITV for repetition of skills and computations, but they tended not to favor such use. Teachers from states or provinces with no competancy testing clearly disagreed with Item 9. They did not see repetition of skills as a reason for selecting ITV programs.[5]

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[5] For Item 7, N=32, Chi^2=.2159, two-tailed probability-.642.

For Item 9, N-32, Chi^2=3.583, two-tailed probability=.058, one-tailed probability=.029.

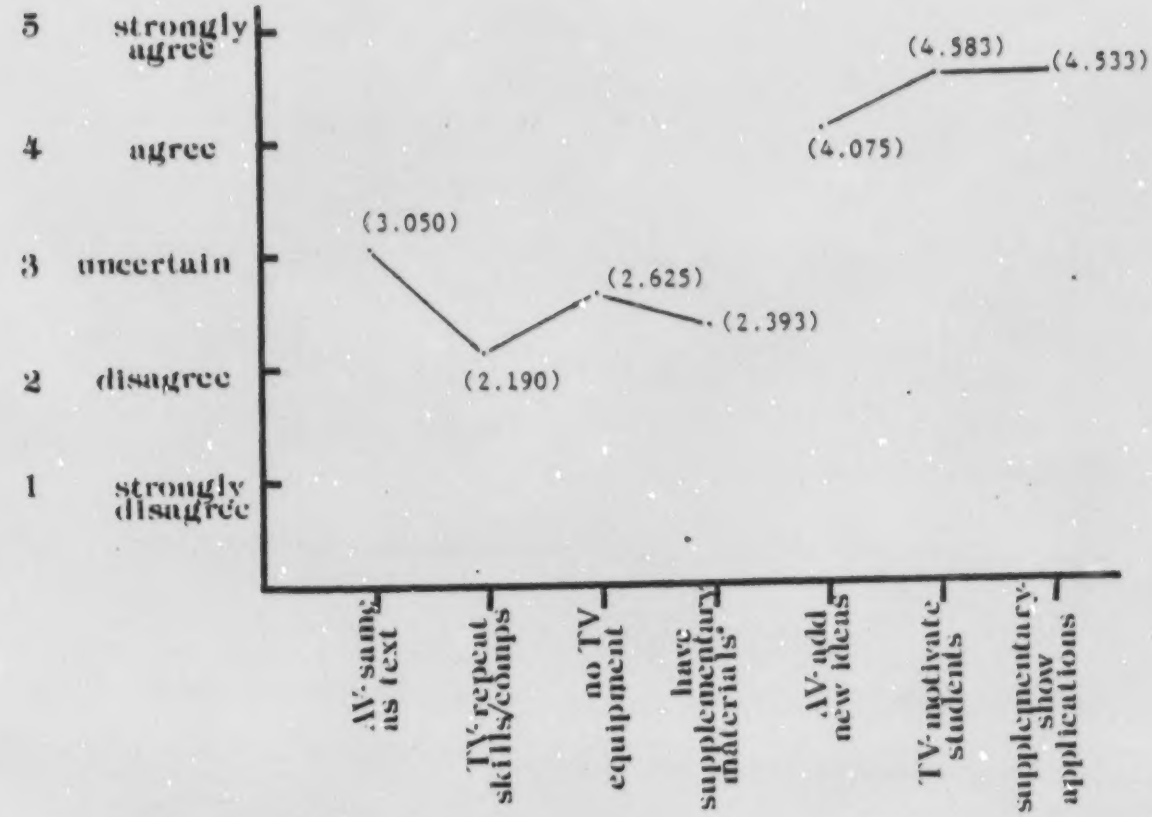

Figure 2. Median teacher responses to items relating to the function of supplementary materials.

Perceived Student Characteristics

Teachers responded to six items relating to their perceptions of general mathematics students. Table 11 provides the percentages of response across categories for each item. Three items deal with eagerness to learn, entry-level skills, and intellectual capability in comparison to algebra students. The teachers' overall reactions to these statements suggested a dim view of students' motivation, capability, and entry skill levels (see Figure 3).

On the other hand, teachers saw students as underestimating their knowledge and competancies. Teacher views were similar for both competancy and no competancy testing sites.[6] Teachers, as a group, agreed that demonstrating the value of mathematics and helping students change their attitudes are likely to facilitate success in mathematics; these responses further confirmed the series goals. As before, the second item on Figure 3 has been recoded.

TABLE 11

Percentages of Teacher Response in Each Category to Items Focusing on Student Characteristics

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Most general mathematics students are fairly eager to learn. (N=33)	6	15	9	52	18
Few students have the entry level skills required by general math textbooks and materials. (N=33)	15	42	21	18	3
Most general mathematics students are as intellectually capable as those who enroll in algebra. (N=33)	3	9	9	55	24
Most general math students underestimate their knowledge and competancies. (N=29)	24	55	10	10	--
Attitude change is often a crucial ingredient for success in general math classes. (N=29)	52	48	--	--	--
Demonstrating the value of mathematics in everyday situations motivates students to learn. (N=29)	28	52	17	3	--

[6]Two-sample median test: N=29, exact 2-tailed probability=.118.

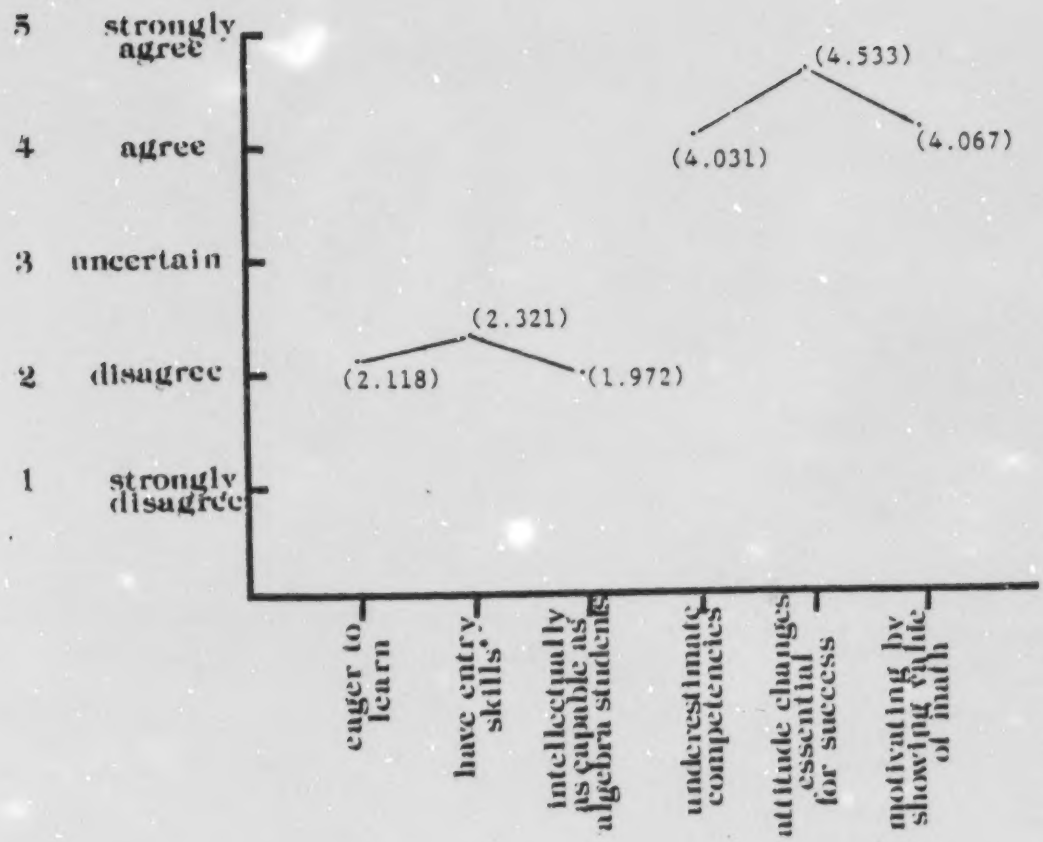

Figure 3. Median teacher responses to items relating to characteristics general mathematics students.

Summary

Thirty-three general mathematics teachers from five widespread North American regions responded to attitude items regarding issues relevant to the design of the General Mathematics Series.

They reacted to individual items with a sense that teachers, as a group, are well-prepared academically and have received training appropriate to the curriculum area. (Some consortium representatives indicated their tendency to select well-qualified teachers. This might, in part, be responsible for the consensus in this area.)

Teachers provided confirmation that the series' instructional design is appropriately directed at motivating students and at attitude change via demonstration of real-life applications. While reporting a sense of confidence about teaching computations, teachers were not so focused on basic skills that they rejected the idea of an applications emphasis. On the contrary, 100% of the teachers either agreed or strongly agreed that they would like supplementary materials presenting applications to real-life situations. They were in agreement that audiovisual materials should add ideas to a curriculum and go beyond what is presented in a text. Motivating students to see mathematics in a new way was heavily favored as a reason for selecting television materials.

The group was divided on the issue of competancies as a major focus of general mathematics instruction. However, teachers from states with competency testing are not necessarily the ones who agree with competency as a major focus. Although the series' emphases on application and attitude change were endorsed by the group, the series must be able to find

its place in a subject-matter area in which competancies and skills obviously play important roles. Program and print materials which clearly help students build bridges between processes and skills, skills and applications will likely appeal to a wide-ranging audience.

Design team concerns about possible negative teacher attitudes toward general mathematics students were partially confirmed. Teachers tended to see their students as poorly prepared intellectually and with respect to skills. Their reactions suggested that they perceive little eagerness to learn among students. However, teachers reacted with some hope that students underestimate their knowledge and that the attitude change crucial to success is possible. One agreed-upon means of motivating students was the demonstration of the value of mathematics in everyday life.

STUDENT ATTITUDES AND AWARENESS OF APPLICATIONS

Because one of the series goals involves student attitudes toward mathematics, an integral part of the background information included an assessment of attitudes. Similarly, the awareness of applications of mathematics is a second dimension of outcome for which relevant baseline information was desirable.

Baseline information can provide guidance with respect to the point at which the series should begin, that is, the level of attitudes and awareness which can safely be assumed. A parallel example in instructional materials designed to teach computational skills would be the specification of entry level behaviors. Theoretically, learning occurs with exposure beyond the entry level; review occurs with exposure that precedes the entry level. To broaden the range of student awareness of application, the General Mathematics programs must attempt to incorporate applications which are relevant to students and go beyond their present level of awareness. To foster a more positive attitude, the programs and print materials must be focused at the present attitude and be sensitive to areas of possible change via new information or identification with characters in the programs.

In order to examine either dimension, the development of instruments was necessary. This section of the report describes measures developed and the information gathered from the 1979-80 class of students.

Development of Questionnaires

The development of each instrument was guided by aspects of the General Mathematics series instructional design. The instructional design was reflected in the content of items as well as the overall purpose of each questionnaire. Because attitude assessment is difficult, and interpretation often tenuous, the development of statistically reliable measures was considered a necessity for even minimal success. A sample of students from the formative evaluation pool aided in the development of the instruments.

Attitude Scale

The instrument for measuring student attitudes toward mathematics (Questionnaire D, Appendix A) was developed from already existing items. All items were 5-point Likert items, requiring responses, ranging from Strongly Agree to Strongly Disagree. Two sources for items were a brief scale previously developed by the chief consultant to the series, Jerry McIntosh, and the National Assessment of Educational Progress released exercise set (1979). Other items were developed specifically for use with this research.

In terms of face validity, the content of items related to several facets of attitude and to the series design. For example, some state-

ments related to finding mathematics a positive or negative affective experience; others focused on math as a practical or vocational asset. Recognizing the usefulness and importance of math in everyday life is integral to the program objectives of the series and several items focused on this issue. Some items related to the design model, for example, "Knowing mathematics helps me become a better problem solver," or "Estimating is an important mathematical skill." By including a variety of items, we implicitly accepted a broad definition of attitude.

Awareness Questionnaire

The need to assess awareness of mathematics applications also required development of a questionnaire (Questionnaire E, Appendix A). No large body of previous research, however, was available to guide the process as had happened with the attitude scale. Consequently, the design team provided ideas about what awareness of application means to the project; the resulting ideas suggested several complementary sets of items, only one of which is reported here.

The items reported here involve a general response to the application of a discrete mathematical process. Questionnaire E lists mathematical activities and asks students to think how often that activity occurs in everyday life. Students checked a five-point Likert scale, ranging from Very Often to Not Often at All. The individual items on Questionnaire E were coordinated with the mathematical processes, content topics, and problem-solving techniques in the general mathematics

design model.[7]

Reliability Sample

Both questionnaires were submitted to a pre-post-reliability study in which youngsters from Alberta, Arkansas, and Vermont responded to the questionnaire on two occasions, a week to ten days apart. The pre-post sample included 327 students representing five grade levels. Table 12 provides the frequency and percentage of the sample in each grade. While no eleventh grade classes were reported by teachers, some eleventh graders may have been enrolled in sections identified by other grade levels.

TABLE 12

Number and Percentages of General Mathematics Students in Each Grade Level of the Pre-Post Reliability Sample

Grade	Attitude Scale		Awareness Questionnaire	
	N	Adj. %	N	Adj. %
8	17	9	--	--
9	121	61	94	72.9
10	57	29	32	24.8
11	--	--	2	1.6
12	2	1	1	0.8
Blank	1	--	--	--
TOTAL	198	100	129	100.1

[7]Other means of assessing awareness were considered. First, a general awareness can be indicated by the endorsement that math is important to solving everyday problems. The attitude scale previously described contained several such general statements.

Second, a set of items could be constructed from the specific applications demonstrated in scripts; such items would demonstrate recognition of applications. In addition, open-ended items asking students to list applications are used on formative questionnaires; this represents another means of tapping recall or recognition. Interviews and class discussion can complement the paper and pencil questionnaires. At this point, the research itself is in a developmental process. Questionnaire E is only one means of assessing awareness.

Table 13 shows the breakdown by sex; the percentages are row percentages so that the proportion of males and females is evident for each questionnaire.

TABLE 13

Number and Row Percentages of Each Sex in the General Mathematics Pre-Post Reliability Sample

	Male	%	Female	%	Blank	%	Total	%
Attitude Scale	109	55	85	43	4	2	198	100
Awareness Questionnaire	72	56	56	43	1	1	129	100
TOTAL	181	53.4	141	43.1	5	1.5	327	100

Reliability of Questionnaires

For the attitude scale (Questionnaire D) fifty-one items formed the initial pool. An initial internal reliability estimate (Cronbach's Alpha) of r = .897 was obtained on the pretest data. The test-retest reliability of the total attitude score was computed, using a Pearson correlation. The correlation of .383 was significant at the .001 level. Both statistical measures proved encouraging to the development of the questionnaire.

Using item-analysis procedures, 9 of the 51 items were deleted.[8] The internal reliability was improved somewhat (alpha = .917). The reliability over time changed slightly, also in a favorable direction (Pearson r = .395, p = .001).

For the awareness items (Questionnaire E), the initial reliability

[8]Deleted items were as follows: 2, 6, 7, 9, 12, 15, 31, 33, 38.

of the scale as a whole was satisfactory. Measures of internal consistency were run on 82 valid cases of the 129 students who completed the pretest of 28 items (alpha =.901). Test-retest reliability was statistically significant at the .001 level for all 129 cases (Pearson r=.783). No items were deleted from this questionnaire since each item contributed a distinct mathematics process or activity to the instrument and both reliability measures indicated satisfactory psychometric characteristics.

Background Research Results

The background research results were based on data collected in four states and one Canadian province; all were part of the student pool previously described. Classes were randomly assigned to either the attitude (Questionnaire D) or awareness (Questionnaire E) sample before questionnaire packets were given to teachers. Included are the pretest responses of students in the reliability sample. Classes not in the reliability sample filled out a questionnaire on only one occasion.

Questionnaires were administered by classroom teachers in the week following the teacher orientation meeting. Dates of the orientation meetings differed from one location to another, but all data was collected and returned by mail during the period of late February through early April, 1980.

The results for the attitude scale (Questionnaire D) are reported first, followed by the awareness (Questionnaire E) information. For each, demographic group comparisons were based on an overall attitude or awareness score. Students responses to individual items were also analyzed for each of the questionnaires.

Student Attitude Results--Questionnaire D

Student attitude toward mathematics is a focus for the entire series.

Both global attitude and more discrete aspects of math attitude are relevant to the series design. Comparisons of demographic groups within the attitude sample are presented first, followed by a discussion of individual attitude items.

Attitude Sample. Fifteen classrooms were assigned the attitude towards mathematics questionnaire. The total of 302 general mathematics students included 130 females (43%), 168 males (56%), and 4 students (1%) who did not specify sex. The largest proportion of students were ninth graders (N=178, 59%); other grades were represented as follows: grade 8 (N=17, 6%); grade 10 (N=75, 25%); grade 11 (N=1, 0.3%); grade 12 (N=27, 9%); no grade specified (N=4, 1.3%).

Attitude Results. Several analyses were done comparing various demographic groups using the revised set of 42 items. A total attitude score was computed for each student by summing across all items. Fifteen negatively phrased items were recorded so that all high item scores indicated a favorable attitude toward mathematics[8] recoding involves a simple reversal of scoring, a standard procedure in the use of Likert scales. These overall attitude scores allowed consideration of questions such as the following: Are boys' attitudes, on the average, more positive than girls' within this sample? Are differences in average level of attitude significant when other demographic characteristics are compared?

When all grade levels were included, the attitude scores of females were significantly more favorable towards mathematics than the attitude scores of males. The average attitude score for females ($\bar{X}_f$=153.32) was significantly higher (p=.02) than the average for males ($\bar{X}_m$=148.20). Table 14 presents the two-way analysis of variance figures for sex by all

[8] Recoded items were as follows: 2, 13, 19, 23, 25, 26, 30, 33, 34, 39, 40, 41, 42, 48, 49.

grade levels. Neither grade level differences nor the interaction of grade and sex was statistically significant. The mean attitude values for grade level, though not significantly different, decreased as grade level increased.

TABLE 14

Sex by Grade (8-12) Analysis of Variance of Total Attitude towards Mathematics Scores

Source of Variance	Sum of Squares	df	F	Significance
Main Effects	5048.931	5	2.466	.033
Sex	2239.527	1	5.469	.020
Grade	2739.950	4	1.673	.156
Interaction				
Sex by Grade	2804.054	3	2.285	.079
Explained	7852.985	8	2.397	.016
Residual	115879.672	283		
Total	123732.658	291		

N=292

However, when grade level differences were limited to the ninth and tenth grade target audience, both main effects for sex and grade were highly significant (p.=.001). Ninth grade attitude scores ($\overline{X}_{9th}$=152.32) were more favorable towards mathematics than tenth grade scores ($\overline{X}_{10th}$=145.07). The female average was more favorable than the male average. The interaction, however, was not significant (p=.350). Table 15 presents the two-way analysis of variance information.

TABLE 13

Sex by Grade (9, 10) Analysis of Variance of
Total Attitude towards Mathematics Scores

Source of Variance	Sum of Squares	df	F	Significance
Main Effects	5893.433	2	7.588	.001
Sex	3218.075	1	8.287	.004
Grade	2684.381	1	6.913	.009
Interaction				
Sex by Grade	339.842	1	.875	.350
Explained	6233.275	3	5.350	.001
Residual	94753.334	244		
Total	100986.609	247		

N=248

Three other demographic characteristics were examined: community type, socioeconomic level (SES), and ability level. As indicated above, assignment of a given characteristic was made on the basis of teacher judgments of the classes as units. These results must be qualified by the recognition that individuals within a given class might not be characterized in the same fashion as the entire class as a group.

The community variable consisted of rural, suburban, and urban groups. Urban, low density, and urban, inner city, categories were collapsed in order to balance the numbers in each group. A one-way analysis of variance was computed for the attitude scores across the three community types. The results were nonsignificant ($F=.493$; $p=.611$), suggesting no differences in attitude scores when classes were grouped by community type.

Classes were also categorized into lower class, lower middle class, or a combined upper middle classes group. Differences among classes

grouped by teacher estimates of class socioeconomic level were also nonsignificant. ($F=1.202$; $p=.303$).

Estimates of the ability level of sections were used in a third analysis of variance. No significant differences occurred when below average, average, and above average student groups were compared with respect to math attitude ($F=1.338$; $p=.265$).

Although teacher judgments of the class ethnic group composition were obtained, no ethnic group comparisons were attempted. As reported in the classroom information section above, minority groups were represented by 16.41% of the sample. In other television field research, Mielke et al. (1978) used four ethnic classifications of respondents based on the percentage of minority and non-minority students in classrooms. A composition of 90-100% minority resulted in a minority classification. In the General Mathematics sample, minority students were present in many classrooms, but no single section was predominantly minority. Consequently, no analysis was attempted.

In summary, when the sample of 302 students was divided into demographic groups, comparisons indicated significant sex and grade level differences. Females were more positive than males in overall attitude towards mathematics; these results, however, will be qualified in the following discussions of responses to individual items. In the target audience, ninth graders were more positive in their overall attitude towards mathematics than were tenth graders. One speculation about increasingly negative attitudes as grade level increases is that students who are tenth graders or beyond have encountered more failure in mathematics, thus laying the foundation

for less positive reactions than younger students. Three other demographic comparisons were nonsignificant statistically; entire classes were judged by their teachers as to community type, socioeconomic level, and ability. None of these variables differentiated students with respect to attitude towards mathematics.

After examining overall attitude scores, individual items were analyzed. All 51 items were included in this phase of the analysis. For each item, the percent in each response category and the median, or average response, are given in Table 16. The negatively stated items were recoded in order to make all medians consistent.

The first impression of individual items is that students were typically fairly positive in their responses. Only 4 median values were below a rating of 3 or "Uncertain." Carpenter, et al. (1980) noted the lack of negative responses among 9 and 13 year old students to math attitude items included in the 1977-78 National Assessment of Educational Progress (NAEP). They cautioned that "since responses are directly under the students' control, they may have responded with what they considered "correct" answers rather than their true feelings" (p. 35). For the General Mathematics sample, a similar desire to give socially "correct" responses might have elevated the median values somewhat. The importance of the individual items, then, lies in the rank order of items and/or the degree of difference between median values.

For 9 items (1, 5, 11, 17, 20, 21, 22, 24, 43), the median value indicated very high degrees of agreement in comparison to other items on the questionnaire. These suggested areas in which student attitude is

TABLE 16

Percent and Median of Response to Math Attitude Categories by Total Sample

No.	Item*	N	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Median
1	Mathematics is useful in solving everyday problems.	300	.7	9.3	7.3	55.3	27.3	4.09
*2	Exploring number patterns play almost no part in mathematics.	295	1.7	17.3	33.9	40.0	7.1	3.42
3	Mathematics is a subject I enjoy.	299	13.0	14.7	25.1	33.8	13.4	3.39
4	I can't understand how some students think math is boring.	299	11.7	38.8	17.7	24.4	7.4	2.49
5	I am willing to work hard to do well in mathematics.	300	2.3	2.0	13.0	56.0	26.7	4.08
6	Mathematics is more for girls than boys.	300	48.0	35.3	11.0	3.0	2.7	1.56
7	Learning mathematics is mostly memorizing.	299	6.7	22.7	15.7	41.1	13.7	3.62
8	Math is interesting to me.	300	9.0	14.3	21.7	42.0	13.0	3.62
9	There is always a rule to follow in solving mathematics problems.	300	1.7	6.7	4.7	57.0	30.0	4.15
10	Most of mathematics has practical use.	299	1.3	7.0	13.7	59.9	18.1	3.97
11	Knowing how to solve a problem is as important as getting the solution.	299	1.0	2.3	5.4	56.2	35.1	4.24

*Some items were stated negatively, and agreement with the item indicated a negative attitude. Recoding reversed the scoring to be consistent with positively stated items; agreement on any item in the table now indicates a positive attitude towards mathematics.

TABLE 16 (cont'd)

No.	Item	N	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Median
12	Doing mathematics requires lots of practice in following rules.	298	1.7	10.4	13.1	55.4	19.5	3.95
*13	I can get along well in everyday life without using mathematics.	300	6.0	11.0	16.0	40.0	27.0	3.93
14	I enjoy math class more than most other classes.	299	19.7	28.4	23.4	17.7	10.7	2.58
15	Fewer men than women have the logical ability to become mathematicians.	300	2.0	10.7	28.7	36.0	22.7	2.26
16	Mathematics is made up of related topics.	300	1.0	5.7	20.7	64.7	8.0	3.85
17	Knowing why an answer is correct is as important as getting the correct answer.	300	1.0	3.3	6.3	56.3	33.0	4.20
18	Mathematics is related to other subjects in school.	299	3.3	12.0	15.1	56.2	13.4	3.85
*19	I am uncomfortable in math class.	299	6.0	17.1	13.4	45.5	18.1	3.80
20	I really want to do well in mathematics.	300	.3	1.3	8.0	52.0	38.3	4.28
21	My parents really want me to do well in mathematics.	300	.3	.3	9.3	40.7	49.3	4.48
22	I feel good when I solve a mathematics problem by myself.	300	1.7	3.7	9.3	50.0	35.3	4.21
*23	No matter how hard I try, I cannot understand mathematics.	300	4.3	7.7	20.7	46.0	21.3	3.88
24	It is important to know arithmetic in order to get a good job.	300	2.0	8.3	11.3	44.3	34.0	4.14

TABLE 16 (cont'd)

No.	Item	N	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Median
*25	I am taking mathematics only because I have to.	299	7.7	16.4	9.4	47.5	19.1	3.85
*26	I don't like to ask a question in math class.	299	7.4	20.4	17.7	39.5	15.1	3.61
27	I am good at mathematics.	299	6.7	20.1	28.4	36.1	8.7	3.32
28	Mathematics helps a person to think logically.	300	1.7	6.3	26.7	52.0	13.3	3.80
29	Knowing mathematics helps one become a better problem solver.	300	2.0	9.7	17.3	58.0	13.0	3.86
*30	There is so much hard work in mathematics that it takes the fun out of it.	299	8.7	18.7	23.7	42.5	6.4	3.45
31	Mathematics is more for boys than girls.	297	1.7	6.4	13.8	39.4	38.7	1.79
32	I would like to take more mathematics.	299	12.4	20.7	30.8	27.4	8.7	3.05
*33	Creative people usually have trouble with mathematics.	300	3.3	10.0	35.0	37.7	14.0	3.54
*34	Mathematics is not really very practical.	300	.7	5.0	24.0	45.0	25.3	3.95
35	I like math books better than other textbooks.	300	9.7	33.3	33.0	20.3	3.7	2.71
36	Estimating is an important mathematical skill.	300	2.3	10.0	17.3	58.7	11.7	3.85
37	I usually understand what we are talking about in mathematics.	300	2.7	12.0	7.3	68.0	10.0	3.91

TABLE 16 (cont'd)

No.	Item	N	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Median
38	Trial and error can often be used to solve a mathematical problem.	300	1.3	11.3	27.0	53.3	7.0	3.69
*39	Math is not as important as other subjects.	300	2.3	8.7	16.3	47.3	25.3	3.98
*40	Doing math problems makes me nervous.	298	3.7	10.7	13.8	56.0	15.8	3.89
*41	Mathematics is boring for me.	300	9.3	16.7	20.0	35.0	19.0	3.61
*42	Mathematics is a subject that is more difficult to understand than other subjects.	300	10.0	27.7	17.3	36.3	8.7	3.21
43	A good grade in mathematics is important.	298	.7	2.3	6.7	47.3	43.0	4.35
44	Being able to say why you do things is an important part of mathematics.	300	1.3	9.0	22.3	50.0	17.3	3.85
45	I like doing math problems more than writing reports.	300	9.3	13.0	19.3	34.0	24.3	3.75
46	I would like to work at a job that lets me use mathematics.	300	12.0	22.0	39.0	20.3	6.7	2.91
47	I am good at working with numbers.	298	4.4	18.8	23.5	45.3	8.1	3.57
*48	Mathematics is too concerned with ideas to be really useful.	298	2.3	14.4	31.9	41.6	9.7	3.53
*49	Most people do not use mathematics in their jobs.	298	2.3	9.4	16.8	47.7	23.8	3.95
50	People who solve mathematical puzzles are clever.	299	3.7	22.4	25.4	40.1	8.4	3.44

TABLE 16 (cont'd)

No.	Item	N	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Median
51	The more math courses you take the better job you can get.	298	7.0	20.1	28.2	28.2	16.4	3.31

already favorable towards mathematics. Five of the 10 related to the importance of doing well in mathematics, willingness to work hard in mathematics, or the sense of accomplishment derived from success in math. Two items related to the sense that mathematics is useful in everyday life or in vocations. Two emphasize the importance of understanding math processes as well as getting a correct answer.

Because students tended to be positive in their responses, only 4 medians for the entire sample were below 3 (the "uncertain" category). Low medians suggested fairly uniform negative attitudes among students about the content of the item. One area of negative reaction was their personal interest in using math vocationally. Students frequently disagreed with the idea of having a job in which math is used. While they asserted, with a fair degree of agreement (Item 24 Median=4.14), that it is important to know "arithmetic" to get a good job, they did not seem attracted to math-related jobs. As a group, they were uncertain about whether "more math courses" would help them get better jobs (Item 51 Median=3.31).

The sample also did not respond positively to affectively toned statements about math as a subject or math classes. For example, they disagreed that math class is more enjoyable than other classes (Item 14 Median=2.58). They fairly often agreed that they were uncomfortable in math class (Item 19 Median=3.80), and mathematics textbooks were not liked in comparison to other texts (Item 35 Median=2.71). Although only modest in their agreement with the statement "Mathematics is boring for me," they were quite sympathetic to the idea that others might find math boring (Items 41 and 4).

The third area of frequent disagreement were statements about sex differences. Strongly disagreed with was "Math is more for girls than for boys" (Item 6 Median=1.56). The companion statement "Math is more for boys

than for girls" was also disagreed with (Item 31 Median=1.79), but to a lesser extent. A third sex-related statement (Item 15 "Fewer men than women have the logical ability to become mathematicians") received little agreement (Median=2.26). Students refused to appear biased in their responses to direct statements concerning one sex or the other in relation to mathematics. Sex differences did occur, however, in both overall attitude and responses to specific items. They are described below.

Because of the significant main effects for sex and grade in the overall attitude score analysis of variance, individual items were examined for sex and grade differences. The median values of each item were tested for differences between female and male students. A second set of median tests compared the differences between ninth and tenth grade students.

Median values for each sex are displayed in Tables 19 tc 20. Statistical significance of the difference between median responses of male and female students is indicated by one asterisk if $p \leq .05$ and by a double asterisk if $p \leq .005$. Sex differences were statistically significant for twelve of the 51 items.

Females differed from males in their greater willingness to work hard and interest in doing well (Items 5 and 20) and thinking of a good math grade as important (Item 43). But, they also differed in feeling less capable (Items 27 and 42). While females were more likely to agree that they were interested in math and math textbooks (Items 35 and 8) or that they felt good when solving problems by themselves (Item 22), they were also more likely than boys to see math as hard work (and no fun) or themselves as reluctant to ask questions (Items 30 and 26).

Items 6 ("Math is more for girls than boys") and 31 (Math is more for

TABLE 17

Items Relating to Competence, Motivation and/or Effort--
Comparison of Median and Modal Responses by Female
and Male General Mathematics Students

No.	Item	Female		Male		Median Test
		Mdn.	Mode	Mdn.	Mode	Significance
5	I am willing to work hard to do well in mathematics.	4.24	4	3.97	4	**
20	I really want to do well in mathematics.	4.42	5	4.19	4	*
21	My parents really want me to do well in mathematics.	4.52	5	4.45	5	
23	No matter how hard I try, I cannot understand mathematics.	3.88	4	3.87	4	
27	I am good at mathematics.	3.06	3	3.57	4	**
37	I usually understand what we are talking about in mathematics.	3.93	4	3.90	4	
39	Math is not as important as other subjects.	4.00	4	3.96	4	
42	Mathematics is a subject that is more difficult to understand than other subjects.	3.58	4	2.93	4	*
43	A good grade in mathematics is important.	4.52	5	4.24	4	*
47	I am good at working with numbers.	3.44	4	3.65	4	
50	People who solve mathematical puzzles are clever.	3.52	4	3.37	4	

N Total=300; N Females=129; N Males=171

TABLE 18

Items Relating to the "Everyday" or Vocational Benefits of Knowing Mathematics-- Comparison of Median and Model Responses by Female and Male General Mathematics Students

No.	Item	Female		Male		Median Test
		Mdn.	Mode	Mdn.	Mode	Significance
1	Mathematics is useful in solving everyday problems.	4.10	4	4.09	4	
10	Most of mathematics has practical use.	3.96	4	3.97	4	
13	I can get along well in everyday life without using mathematics.	3.92	4	3.93	4	
24	It is important to know arithmetic in order to get a good job.	4.13	4	4.15	4	
28	Mathematics helps a person to think logically	3.79	4	3.80	4	
29	Knowing mathematics helps one become a better problem solver.	3.82	4	3.89	4	
34	Mathematics is not really very practical.	3.86	4	4.02	4	
46	I would like to work at a job that lets me use mathematics.	2.91	3	2.91	3	
49	Most people do not use mathematics in their jobs.	3.95	4	3.95	4	
51	The more math courses you take the better job you can get.	3.27	4	3.34	3	

N=300; N females=129; N Males=171

TABLE 19

Affectively Phrased Attitude Items--Comparison of Median and Modal Responses of Female and Male General Mathematics Students

No.	Item	Female		Male		Median Test Significance
		Mdn.	Mode	Mdn.	Mode	
3	Mathematics is a subject I enjoy.	3.60	4	3.19	4	
4	I can't understand how some students think math is boring.	2.66	2	2.43	2	
8	Math is interesting to me.	3.62	4	3.62	4	*
14	I enjoy math class more than most other classes.	2.77	2	2.45	2	
19	I am uncomfortable in math class.	3.91	4	3.72	4	
22	I feel good when I solve a mathematics problem by myself.	4.34	4	4.10	4	*
25	I am taking mathematics only because I have to.	3.94	4	3.78	4	
26	I don't like to ask a question in math class.	3.80	4	3.45	4	*
30	There is so much hard work in mathematics that it takes the fun out of it.	3.66	4	3.21	4	*
32	I would like to take more mathematics.	3.11	3	2.99	3	
40	Doing math problems makes me nervous.	3.91	4	3.87	4	
41	Mathematics is boring for me.	3.84	4	3.33	4	
45	I like doing math problems more than writing reports.	3.66	4	3.79	4	

N Total=300; N Females=129; N Males=171

TABLE 20

Attitude Items Relating to Problem Solving and Other Issues--
Comparison of Responses of Female and Male General Mathematics Students

No	Item	Female		Male		Median Test Significance
		Mdn.	Mode	Mdn.	Mode	
2	Exploring number patterns play almost no part in mathematics.	3.46	4	3.38	4	
6	Mathematics is more for girls than boys.	1.33	1	1.79	2	*
51	Mathematics is more for boys than girls.	1.44	1	2.03	2	**
7	Learning mathematics is mostly memorizing.	3.65	4	3.58	4	
9	There is always a rule to follow in solving mathematics problems.	4.16	4	4.14	4	
11	Knowing how to solve a problem is as important as getting the solution.	4.33	4	4.17	4	
12	Doing mathematics requires lots of practice in following rules.	3.97	4	3.93	4	
16	Mathematics is made up of related topics.	3.91	4	3.80	4	
17	Knowing why an answer is correct is as important as getting the correct answer.	4.28	4	4.14	4	
18	Mathematics is related to other subjects in school.	3.89	4	3.82	4	
53	Creative people usually have trouble with mathematics.	3.67	4	3.44	4	
55	I like math books better than other textbooks.	2.83	2	2.64	3	*
56	Estimating is an important mathematical skill.	3.85	4	3.85	4	
58	Trial and error can often be used to solve a mathematical problem.	3.64	4	3.73	4	
48	Mathematics is too concerned with ideas to be really useful.	3.50	4	3.56	4	
15	Fewer men than women have the logical ability to become mathematicians.	2.15	2	2.34	2	

N Total=300, N Females=129, N Males=171

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boys than for girls") presented an interesting contrast by suggesting that math is more for one sex than the other. Medians for both sexes were low on both items indicating substantial disagreement with the statements on the part of both sexes. Girls, however, strongly disagreed with medians of 1.33 and 1.44. Female modal (or most common rating) values were 1 for both items. While disagreeing, males were significantly less adamant and the male modal values were 2 in each case. While females may be changing some aspects of math attitude, they continue to feel less capable, reluctant to ask questions and to see the task as difficult.

The obvious implication for the General Mathematics series is a need to consciously focus on female interests, as well as traditional male interests. The modeling of behavioral changes in female target ages can demonstrate the possibility of attaining more sense of capability and self-confidence.

The sex differences discussed above are consistent with related research findings. Female math anxiety and enrollment research are examples. For discussion of important social and educational implications, see Sells (1980) and reports available from the Education Commission of the States (1980).

A second set of median tests assessed the differences in average response by ninth and tenth graders. Six items resulted in differences significant at the .05 level. When the constellation of significantly different items based on sex groups is compared to the constellation based on grade, surprisingly little overlap occurred.

For all five individual items on which grade level differences were significant the ninth graders were more positive than tenth graders. This outcome is, of course, consistent with the overall attitude score analyses

by grade level. Ninth graders agreed significantly more often than tenth graders with the statements "I really want to do well in mathematics" and "My parents really want me to do well in mathematics." (Items 20 and 21, respectively). They were also more convinced that knowing arithmetic is important to getting a good job (Item 24). They reported significantly more enjoyment of mathematics class (Item 14) than did tenth graders.

When recoded, two negatively phrased statements (Items 23, 30) further illustrated the more positive ninth grade attitude towards mathematics. Ninth graders were more optimistic about understanding mathematics than their older counterparts. Ninth graders were also less likely to see hard work as taking all the fun out of math.

Although the other item differences are not statistically significant, an inspection of Tables 21 to 24 make clear the more positive attitude of ninth graders. On only seven items were tenth grade medians higher than the ninth grade ones.

Summary of Attitude Results

Student responses were generally favorable toward mathematics, but the influence of a desire to give socially desirable responses may be present. Comparisons of subgroups within the sample and individual attitude items were instructive for program development.

With respect to overall attitude, female attitudes were more positive than males; and, in the targeted grades nine and ten, the younger students were more positive in attitude. Three other demographic variables (community type, SES, and ability level) failed to differentiate student attitudes

The General Mathematics Series can be profitably aimed at several areas of needed attitude change. For female students, who responded with a desire

TABLE 21

Median and Modal Responses by Grade Level --
Items Relating to Competence, Motivation and/or Effort

No.	Item	Grade 9 Mdn.	Grade 9 Mode	Grade 10 Mdn.	Grade 10 Mode	Median Test Significance
5	I am willing to work hard to do well in mathematics.	4.13	4	4.02	4	
20	I really want to do well in mathematics.	4.36	4	4.18	4	*
21	My parents really want me to do well in mathematics.	4.58	5	4.30	4	*
*23	No matter how hard I try, I cannot understand mathematics.	3.94	4	3.72	4	*
27	I am good at mathematics.	3.39	4	3.22	4	
37	I usually understand what we are talking about in mathematics.	3.92	4	3.84	4	
*39	Math is not as important as other subjects.	4.03	4	3.78	4	
*42	Mathematics is a subject that is more difficult to understand than other subjects.	3.37	4	2.82	2	
43	A good grade in mathematics is important to me.	4.47	5	4.25	4	
47	I am good at working with numbers.	3.57	4	3.48	4	
50	People who solve mathematical puzzles are clever.	3.26	4	3.57	4	

TABLE 22

Median and Modal Values by Grade Level of Items Relating to the "Everyday" or Vocational Benefits of Knowing Mathematics

No.	Item	Grade 9 Mdn.	Grade 9 Mode	Grade 10 Mdn.	Grade 10 Mode	Median Test Significance
1	Mathematics is useful in solving everyday problems.	4.08	4	3.96	4	
10	Most of mathematics has practical use.	3.99	4	3.76	4	
*13	I can get along well in everyday life without using mathematics.	3.96	4	3.77	4	
24	It is important to know arithmetic in order to get a good job.	4.24	4	3.95	4	*
28	Mathematics helps a person to think logically.	3.79	4	3.77	4	
29	Knowing mathematics helps me become a better problem solver.	3.94	4	3.73	4	
*34	Mathematics is not really very practical.	3.95	4	3.83	4	
46	I would like to work at a job that lets me use mathematics.	2.99	3	2.65	3	
47	Most people do not use mathematics in their jobs.	3.99	4	3.73	4	
51	The more math courses you take the better job you can get.	3.44	4	3.05	2	

TABLE 23

Median and Modal Responses by Grade Level --
Affectively Phrased Items

No.	Item	Grade 9 Mdn.	Grade 9 Mode	Grade 10 Mdn.	Grade 10 Mode	Median Test Significance
3	Mathematics is a subject I enjoy.	3.47	4	3.06	3	
4	I can't understand how some students think math is boring.	2.60	2	2.43	2	
8	Math is interesting to me.	3.66	4	3.46	4	
14	I enjoy math class more than most other classes.	2.86	3	2.20	2	*
*19	I am uncomfortable in math class.	3.87	4	3.39	4	
22	I feel good when I solve a mathematics problem by myself.	4.23	4	4.12	4	
*25	I am taking mathematics only because I have to.	3.90	4	3.77	4	
*26	I don't like to ask a question in math class.	3.56	4	3.63	4	
*30	There is so much hard work in mathematics that it takes the fun out of it.	3.58	4	3.00	4	*
32	I would like to take more mathematics.	3.07	3.	2.92	3	
*40	Doing math problems makes me nervous.	3.90	4	3.83	4	
*41	Mathematics is boring for me.	3.75	4	3.19	3	
45	I like doing math problems more than writing reports.	3.85	4	3.52	4	

TABLE 24

Median and Modal Response by Grade Level --
Items Relating to Problem Solving
and Other Issues

No	Item	Grade 9 Mdn.	Grade 9 Mode	Grade 10 Mdn.	Grade 10 Mode	Median Test Significance
*2	Exploring number patterns plays almost no part in mathematics.	3.54	4	3.33	4	
6	Mathematics is more for girls than boys.	1.56	1	1.72	1	
7	Learning mathematics is mostly memorizing.	3.54	4	3.63	4	
9	There is always a rule to follow in solving mathematics problems.	4.18	4	4.05	4	
11	Knowing how to solve a problem is as important as getting the solution.	4.22	4	4.17	4	
12	Doing mathematics requires lots of practice in following rules.	3.97	4	3.94	4	
16	Mathematics is made up of related skills.	3.84	4	3.62	4	
17	Knowing why an answer is correct is as important as getting the correct answer.	4.15	4	4.19	4	
18	Mathematics is related to other subjects in school.	3.82	4	3.83	4	
*33	Creative people usually have trouble with mathematics.	3.46	3	3.55	4	
35	I like math books better than other textbooks.	2.90	3	2.39	2	
36	Estimating is an important mathematical skill.	3.85	4	3.69	4	
38	Trial and error can often be used to solve a mathematics problem.	3.53	4	3.86	4	
*48	Mathematics is too concerned with ideas to be really useful.	3.56	4	3.33	4	
*45	Fewer men than women have the logical ability to become mathematicians.	3.61	4	3.81	4	
*51	Mathematics is more for boys than for girls.	4.22	5	4.16	4	

to succeed, programs can encourage their overcoming the personal misgivings which were significantly more evident than in male responses. On the other hand, males might be more generally disengaged or removed from active interest in mathematics. While they acknowledged less personal misgiving, they also acknowledged less concern to do well than females. Characters in the programs may be identified with more readily if they represent these attitudes and then develop in a more positive direction. (It should be noted, however, that most students, male and female, acknowledged the importance and usefulness of math. Stronger negative responses were reserved for math-related jobs and experiences in math classes.)

As grade level increases, students' attitudes seem to become more negative; a need to be sensitive to the reality of repeated failures among students may suggest the deliberate demonstration of compensation strategies (e.g. use of heuristics like estimating, instead of trial and error, use of similar but simpler problems, and the legitimacy of aids like calculators). Compensation strategies may be a realistic means to success and improved attitude for some of the older students. Older students were less personally committed to doing well and less optimistic about understanding math.

Student Awareness of Applications Results - Questionnaire E

Increasing student awareness of mathematics applications is an important element in the series design. Mathematics applied to everyday situations will be demonstrated in each of the 12 programs. Demographic group comparisons are again reported first. Analysis of individual mathematics activities follow the demographic comparisons.

Sample. Fifteen classrooms in four states and one Canadian province returned awareness of applications questionnaires. The total of 226 general mathematics students included 99 females (44%), 125 males (55%), and 2 students (1%) who did not specify sex. A large majority of the students were ninth graders (N=148, 65%); other grades were represented as follows: grade 8 (N=2, 1%); grade 10 (N=58, 26%); grade 11 (N=11, 5%); and grade 12 (N=7, 3%).

Awareness Results. For purposes of comparing subgroups based on demographic characteristics, an overall awareness score was computed for each student by summing across the ratings assigned each of the 28 items. A high score suggests great awareness of application as reported by students.

Differences in awareness were not significant statistically for females vs. males or ninth vs. tenth graders. Ninth graders responded in a manner very similar to tenth graders. Two-way analyses of variance resulted in no significant main effects for grade or sex and no significant interaction of the two variables. Tables 25 and 26 display the relevant statistics for two analyses of variance; the first included all grades 8 to 12, and the second selected ninth and tenth graders only.

Community type, socioeconomic (SES) level, and ability-level differences were assessed using one-way analyses of variance. The same three levels

TABLE 25

Sex by Grade (8-12) Analysis of Variance of
Total Awareness of Application Scores

Source of Variance	Sum of Squares	df	F	Significance
Main Effects	2359.549	5	1.342	.248
Sex	968.566	1	2.754	.098
Grade	1574.678	4	1.119	.348
Interaction				
Sex by Grade	2395.450	4	1.703	.151
Explained Variance	4754.999	9	1.502	.149
Residual Variance	75266.930	214		
Total	80021.929	223		

N=224

TABLE 26

Sex by Grade (9, 10) Analysis of Variance of
Total Awareness of Application Scores

Source of Variance	Sum of Squares	df	F	Significance
Main Effects	1132.080	2	1.706	.184
Sex	981.798	1	2.960	.087
Grade	136.794	1	.412	.521
Interaction				
Sex by Grade	851.381	1	2.567	.111
Explained Variance	1983.461	3	1.993	.116
Residual Variance	66675.388	201		
Total	68658.849	204		

N=205

of each variable were used as described in the report of the attitude data. Awareness of mathematics applications did not significantly differ across ability levels (F=.447, p=.640). However, both SES-level estimates and community-type classifications resulted in significant differences among the groups, and they are discussed in some detail.

Classification of students based on the teacher's estimate of an SES level of the class as a whole differentiated among high and low levels of mathematics awareness. A one-way analysis of variance (Table 27) was significant beyond the .05 level.

TABLE 27

Analysis of Variance of Awareness
of Application Across Three SES Levels

Source of Variance	Sum of Squares	df	F	Significance
Between Groups	2530.106	2	3.611	.029
Within Groups	68326.048	195		
Total	70856.207	197		

N=198

Scheffe's multiple comparison test indicated a significant difference ($p<.05$) between the lower SES group ($\bar{X}_L=71.93$) and the combined middle and upper SES groups ($\bar{X}_U=81.88$). The lower middle-level group ($\bar{X}_M=78.56$) did not differ significantly from either of the extreme groups. The means increased as the estimated SES of the classes increased.

For community type, the analysis of variance indicated highly significant differences between the three community groupings: rural, suburban, and urban (Table 28). According to Scheffe's test, the average awareness of mathematics applications for suburban classes ($\overline{X}_S$=81.57) was significantly higher than that of urban classes ($\overline{X}_{Ub}$=72.07). The average awareness for rural classes ($\overline{X}_R$=74.75) did not differ from either urban or suburban classes. While the community-type analysis of variance was statistically significant, the rural group consisted of only one classroom. Because of the single class, the external validity of the analysis is questionable. One would be hard-pressed to say that a single rural class can adequately represent all rural classes.

TABLE 28

Analysis of Variance of Awareness
of Application Across Three Community Types

Source of Variance	Sum of Squares	df	F	Significance
Between Groups	3564.350	2	5.057	.007
Within Groups	64849.426	184		
Total	68413.775	186		

N=187

Fortunately, further analysis of the urban and suburban classes revealed a relationship between SES level and community. All urban classes were also lower SES classes, and all of the combined middle and upper-middle SES classes were suburban community type. Consequently, the two analyses were somewhat

redundant. The most reasonable conclusion is that on awareness of math applications lower SES urban classes differed significantly from upper-middle SES suburban classes. Lower SES urban classes reported seeing far fewer applications of mathematics activities in their lives than do upper-middle SES suburban classes.

Questionnaire E items were analyzed individually by comparing the percent of response in each of the five categories (Very Often to Not Often at All). The items and the percent of response by the total sample and the three SES subsamples are listed below in Table 29.

The average response of students was determined by use of the median for each item. Medians were computed for the total sample and each of the SES subsamples. Table 30 lists the items in rank order of the total sample medians. The first mathematics activity on the table is the least often seen as applicable by the total group of students. For example, making, or looking for a pattern in, a table of numbers; making a map or scale model; working with ratios; and using formulas to solve measurement problems were not seen as likely activities in which students might engage. On the other hand, estimating, or working with measurements; checking answers by going over a problem; and following a map were among those rated as frequently applicable.

The individual items seldom seen as applicable (making tables, looking for a pattern in a table, making maps and/or scale models, working with ratios and using formulas to solve measurement problems, suggest useful applications to explore in program development. To the degree that they can be paired with those seen as often applicable, the programs can start at a point compatible with present student awareness and extend the awareness. For example, "following a map" was rated as more often applied than "making

TABLE 29

Percent of Response to Each Mathematics Awareness Category by Item for Total Sample and SES Groups

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
1. get information about a small group in order to guess about the whole group.					
Total Sample (N=204)	4	22	23	32	18
Lower (N= 41)	2	20	32	32	15
Lower Middle (N= 79)	6	16	24	30	23
Middle/Upper (N= 60)	5	28	17	35	15
2. estimate answers to problems.					
Total Sample (N=226)	13	41	11	31	4
Lower (N= 41)	3	44	15	27	7
Lower Middle (N= 90)	13	39	10	33	4
Middle/Upper (N= 67)	16	48	6	28	1
3. find volumes.					
Total Sample (N=209)	9	20	22	34	20
Lower (N= 37)	0	11	22	35	32
Lower Middle (N= 86)	6	20	24	35	15
Middle/Upper (N= 63)	3	24	16	37	19
4. make a table of numbers.					
Total Sample (N=219)	13	16	11	42	24
Lower (N= 39)	3	15	13	26	44
Lower Middle (N= 89)	6	12	9	47	26
Middle/Upper (N= 64)	6	19	13	45	17

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
5. memorize rules and formulas.					
Total Sample (N=223)	16	39	11	21	13
Lower (N= 41)	7	32	17	24	10
Lower Middle (N= 90)	10	40	17	18	16
Middle/Upper (N= 67)	22	49	3	18	7
6. make a scale model.					
Total Sample (N=218)	7	17	14	34	28
Lower (N= 39)	3	18	18	31	31
Lower Middle (N= 86)	7	15	14	34	30
Middle/Upper (N= 67)	9	19	12	39	21
7. estimate measurements (lengths, widths, areas, etc.).					
Total Sample (N=225)	19	46	9	17	9
Lower (N= 41)	24	44	7	17	7
Lower Middle (N= 90)	14	48	9	19	10
Middle/Upper (N= 67)	19	46	12	15	7
8. check an answer to a problem by going back over it.					
Total Sample (N=226)	21	42	10	21	6
Lower (N= 41)	15	44	15	22	5
Lower Middle (N= 90)	20	47	4	21	8
Middle/Upper (N= 67)	19	42	13	6	19

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
9. describe a relationship by using a ratio.					
Total Sample (N=207)	3	20	22	30	25
Lower (N= 35)	3	17	23	34	23
Lower Middle (N= 84)	0	17	29	26	29
Middle/Upper (N= 61)	7	21	18	38	16
10. change measures to the same unit in order to compare them.					
Total Sample (N=219)	11	31	19	23	16
Lower (N= 41)	7	24	17	34	17
Lower Middle (N= 85)	9	31	24	18	19
Middle/Upper (N= 67)	18	39	15	21	7
11. look at a table of numbers for a pattern.					
Total Sample (N=221)	16	23	16	37	17
Lower (N= 39)	3	21	21	36	21
Lower Middle (N= 89)	12	19	12	38	18
Middle/Upper (N= 66)	5	27	21	36	11
12. follow a map.					
Total Sample (N=225)	23	37	9	23	8
Lower (N= 41)	22	22	12	37	7
Lower Middle (N= 90)	23	37	11	20	9
Middle/Upper (N= 67)	28	43	4	18	6

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
13. make a diagram.					
Total Sample (N=215)	10	32	13	35	11
Lower (N= 40)	7	22	5	48	18
Lower Middle (N= 88)	5	31	18	33	14
Middle/Upper (N= 62)	18	42	10	29	2
14. figure the odds on whether or not something will happen.					
Total Sample (N=216)	13	35	19	22	12
Lower (N= 40)	15	38	15	20	13
Lower Middle (N= 88)	10	31	24	26	9
Middle/Upper (N= 62)	11	39	15	24	11
15. work with fractions.					
Total Sample (N=219)	17	36	8	28	11
Lower (N= 41)	0	29	10	37	24
Lower Middle (N= 90)	21	34	8	27	10
Middle/Upper (N= 62)	21	40	6	24	8
16. work with measures (lengths, weights, or temperatures).					
Total Sample (N=218)	20	39	12	23	5
Lower (N= 41)	12	37	15	27	10
Lower Middle (N= 90)	14	39	14	28	4
Middle/Upper (N= 62)	32	44	8	13	3

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
17. find the average of a set of numbers.					
Total Sample (N=217)	6	34	17	34	10
Lower (N= 41)	5	27	17	34	17
Lower Middle (N= 89)	4	44	10	31	10
Middle/Upper (N= 62)	5	29	23	37	6
18. work with percentages.					
Total Sample (N=218)	12	41	13	24	10
Lower (N= 41)	2	22	20	37	20
Lower Middle (N= 88)	16	48	10	18	8
Middle/Upper (N= 62)	11	42	16	23	8
19. use charts and graphs.					
Total Sample (N=216)	9	29	13	35	14
Lower (N= 41)	2	17	15	39	27
Lower Middle (N= 89)	12	29	10	38	10
Middle/Upper (N= 62)	6	37	15	29	13
20. work with decimals.					
Total Sample (N=217)	19	40	10	25	6
Lower (N= 41)	7	27	7	42	12
Lower Middle (N= 90)	21	39	8	32	7
Middle/Upper (N= 60)	22	48	15	12	3

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
21. find areas.					
Total Sample (N=212)	9	22	21	32	17
Lower - (N= 37)	5	16	11	41	27
Lower Middle (N= 89)	8	16	26	33	18
Middle/Upper (N= 61)	15	34	13	30	8
22. use formulas to solve measurement problems.					
Total Sample (N=216)	8	16	19	33	23
Lower (N= 40)	0	5	18	42	35
Lower Middle (N= 89)	7	11	19	35	28
Middle/Upper (N= 61)	15	26	21	28	10
23. write a ratio as a decimal or percent.					
Total Sample (N=211)	7	17	14	36	25
Lower (N= 36)	3	6	8	42	42
Lower Middle (N= 87)	9	18	17	29	26
Middle/Upper (N= 61)	5	20	15	44	16
24. use proportions to find an unknown, desired number.					
Total Sample (N=205)	2	19	25	36	19
Lower (N= 36)	0	11	25	44	19
Lower Middle (N= 86)	1	19	26	29	26
Middle/Upper (N= 58)	2	17	28	41	12

TABLE 29
(cont'd)

How often would you...	Very Often	Often	Undecided	Not Very Often	Not Often at All
25. look up something in a table of numbers.					
Total Sample (N=214)	5	18	23	36	18
Lower (N= 41)	5	15	27	41	12
Lower Middle (N= 87)	6	17	22	36	20
Middle/Upper (N= 60)	7	20	27	33	13
26. make a map.					
Total Sample (N=219)	9	16	10	41	25
Lower (N= 41)	7	12	10	39	32
Lower Middle (N= 89)	10	17	9	36	28
Middle/Upper (N= 62)	6	18	10	47	19
27. follow a diagram.					
Total Sample (N=217)	11	32	16	28	13
Lower (N= 41)	5	39	7	34	15
Lower Middle (N= 88)	8	32	16	20	24
Middle/Upper (N= 62)	16	35	21	24	3
28. use numbers to convince people.					
Total Sample (N=217)	11	26	20	28	16
Lower (N= 40)	10	22	25	30	13
Lower Middle (N= 89)	8	22	21	30	18
Middle/Upper (N= 62)	16	31	21	23	10

TABLE 30

Awareness of Mathematics Items in Ascending Rank
Order of Total Group Medians
with a Breakdown by SES Subgroup

Rank	*How often would you...*	Total	Medians			Significance
			Lower	Lower Middle	Middle/Upper	
1	make a table of numbers.	2.11	1.75	2.01	2.22	
2	make a map.	2.12	1.97	2.11	2.16	
3	make a scale model.	2.15	2.13	2.09	2.25	
4	write a ratio as a decimal or percent.	2.18	1.70	2.32	2.26	*
5	use formulas to solve measurement problems.	2.31	1.85	2.13	3.08	**
6	describe a relationship by using a ratio.	2.35	2.29	2.32	2.39	
7	use proportions to find an unknown, desired number.	2.37	2.19	2.34	2.42	
8	find volumes.	2.39	2.00	2.50	2.35	
9	look at a table of numbers for a pattern.	2.40	2.32	2.34	2.64	
10	look up something in a table of numbers.	2.41	2.41	2.36	2.63	
11	get information about a small group in order to guess about the whole group.	2.49	2.62	2.40	2.50	
12	use charts and graphs.	2.57	2.09	2.67	3.06	*
13	find areas.	2.59	2.07	2.48	3.44	*
14	make a diagram.	2.82	2.18	2.69	3.73	*

TABLE 30
(cont'd)

Rank	*How often would you...*	Total	Medians			Significance
			Lower	Lower Middle	Middle/Upper	
15	use numbers to convince people.	2.83	2.80	2.58	3.35	
16	find the average of a set of numbers.	2.85	2.46	3.33	2.79	
17	follow a diagram.	3.06	2.67	2.86	3.55	
18	change measures to the same unit in order to compare them.	3.08	2.46	3.08	3.67	*
19	figuring the odds on whether or not something will happen.	3.38	3.57	3.12	3.50	
20	work with percentages.	3.57	2.33	3.79	3.58	**
21	work with fractions.	3.58	2.20	3.66	3.78	**
22	estimate answers to problems.	3.61	3.53	3.56	3.80	
23	memorize rules and formulas.	3.64	3.43	3.50	3.94	
24	work with decimals.	3.72	2.32	3.76	3.91	**
25	work with measures (lengths, weights, or temperatures).	3.74	3.42	3.59	4.09	
26	follow a map.	3.78	3.00	3.77	4.00	
27	check an answer to a problem by going back over it.	3.81	3.69	3.86	3.77	
28	estimate measurements (lengths, widths, areas, etc.).	3.82	3.92	3.76	3.84	

a map." If a program can pick upon following a map which is a more familiar application and then move the program focus to making a map, the sequence should be instructionally aimed at achieving the series goal of increasing awareness of mathematics applications.

A more complex example considers using the reported awareness of "work with percentages" (M_T=3.57) to extend the awareness of ratios. Both "writing a ratio as a decimal or percent" (M_T=2.18) and "describing a relationship by using a ratio" (M_T=2.35) are seen as less applicable than working with percentages. These awarenesses are probably impeded by lack of conceptual understanding as well as lack of everyday experiences. A program or module could use familiar percentages and build towards the relationship between ratios and percents. The description of a relationship by a ratio can be used to tie everyday life to conceptual understandings.

For each item, a Kruskal-Wallis nonparametric one-way analysis of variance was used to test differences among SES levels. The analyses were corrected for ties in the item ranks. When the result for a given item was significant, at least one of the SES groups was generally more (or less) aware of mathematics applications in everyday life. (Significant differences among the SES groups are indicated in Table 30 by one asterisk if $p \leq .05$ and by the double asterisk if $p \leq .005$).

For nine of the 28 items, responses by SES level differed significantly. The wides differences ($p \leq .005$) occurred on four items involving fractions, percentages, decimals and the use of formulas to solve measurement problems. In each case, lower SES level classes saw the activities as less applicable than the other two SES groups. Results were similar for the remaining five items on which significance differences occurred

($p \leq .05$). Wide differences occurred on two items concerning making a diagram and using charts and graphs. SES level groups also differed on three additional items: changing measures to the same unit in order to compare them, writing ratios as a decimal or percent, and finding areas.

The analysis of individual items reflects the overall analysis. Lower SES urban classes do not see mathematics activities as applicable in everyday life to the extent that the middle and upper SES suburban classes do. The usefulness of this data is to make clear the need to present applications which are identifiable to lower SES urban students. Their ability to identify with program characters and events should enhance the relevance of the programs. However, applications clearly related to their present lives and jobs into which they can be expected to go will also be important to the series meeting its goals.

Summary of Awareness Data

In contrast to the attitude data, level of awareness did not differ when sex or grade level were considered. Nor was teacher judgment of class ability level a successful predictor of awareness of applications of mathematical activities. Awareness of applications was related, however, to the community-type and socioeconomic level of the class. Urban classes judged to be of lower SES level responded with significantly lower awareness of mathematics applications than did suburban classes judged to be of middle or upper SES levels. Awareness increased as SES level increased. To what extent lack of awareness is reflected in motivational levels, and ultimately achievement, is unknown but a logical concern for further research.

Mathematical activities rated as frequently applied may be useful in creating a familiar situation to which students can relate easily. Included were estimating, working with measurements, checking answers, and following a map.

Less often encountered math activities were making tables, looking for a pattern in tables, making maps or scale models, several activities involving ratios, and using formulas. These applications and others of moderate familiarity might be useful in extending the awareness of students.

Combinations of related applications can pick up students in familiar mathematical territory and move them to new recognitions. Two examples were provided in the text. The first, using maps, is fairly simple, and the second dealing with ratios is instructionally complex.

One Last Word

This profile of two audiences for the General Mathematics Series has implications for project development activities. Teachers are experienced and feel well prepared academically. The series has potential for filling a teacher-recognized gap; they cited lack of programs and/or acceptable programs as two reasons for not using ITV. Quality programs can be expected to be well received, especially if the content parallels, but goes beyond, textbooks.

The teacher audience has endorsed the goals of the series. They saw ITV as an appropriate medium for communicating with students the type of material intended (applications, new perspectives on math).

Students are seen by teachers as less capable than algebra students but also as being further handicapped by a negative view of themselves. Students

are seen as underestimating their knowledge, and attitude change is considered important. General Mathematics students themselves ranged from 8th to 12th grade with average attitude scores apparently becoming more negative as students get further along in school.

Significant differences occurred between grade levels (9 and 10) and sex groups. In this sample, overall male attitudes were less positive than female attitudes. Responses to individual items suggested that the series should peak the interest of male students and capitalize on the intrigue of problem solving. In contrast, female students require a different change in attitude. While they responded with interest in doing well, personal misgivings exceeded those of male students. These "psychological" differences in attitude were more apparent in the data than "sociological" differences. Community type, SES level of the class and ability of the class all failed to predict attitude differences.

A different picture comes into focus with awareness of the application of mathematical activities. The "sociological" differences were important. Lower SES urban students reported significantly less awareness of times when math is used in everyday life. For all students, some math activities were readily recognized as frequently applicable. The programs have an opportunity to broaden the awareness of students. Students may intellectually acknowledge the importance of mathematics, but television programs can underscore intellectual acceptance by relating less familiar applications via the lives of characters whose experiences relate to the interests and problems of ninth and tenth grade General Mathematics students.

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Appendix A

Teacher and Student Questionnaires

A

Date _____

Secondary General Mathematics Series

Teacher Information

Name _____

Address (Home) _____

Home Phone _____ Times to call: _____

Address (School) _____

School Phone _____ Times to call: _____

TEACHING EXPERIENCE

____ Years as professional educator including this year.

____ Years as a teacher of any subject.

____ Years teaching General Mathematics including this year.

____ Number of general mathematics sections you teach this year.

In what community setting have you taught?

____ Rural ____ Suburban ____ Urban, Inner-City ____ Urban, Other

What content area was your major in secondary education?

____ Math ____ Other - please identify _____

USE OF INSTRUCTIONAL TELEVISION (ITV)

____ Never any introduction to, or use of, ITV for secondary schools.

____ Exposure to use in methods classes when a university student myself.

PRESENT USE OF ITV IN GENERAL MATHEMATICS

____ At least once a week. What programs? _____

____ Occasionally (once a month or irregularly) _____

____ Never. Why? _____

Is equipment available? ____ Yes ____ No

USE OF OTHER SUPPLEMENTAL MATERIALS

What audio-visual materials do you use other than TV, chalk and chalkboard?

_____

_____

_____

PROBLEM-SOLVING APPROACHES

As you know, problem-solving is currently being stressed by math educators. We need to know how much problem-solving focus is feasible in an actual classroom setting. What approach do you take to problem-solving in general mathematics teaching?

_____

_____

_____

How is problem-solving integrated into the curriculum? Please give an example or two.

_____

_____

_____

_____

B

Secondary Project General Mathematics Series
Classroom Information

State or Province _____ City _____

Teacher _____ School _____

Community: _____Rural ____Suburban ____Urban, inner-city ____ Urban, Other

School Address _____

Section # _____: Grade _____ Hour it meets _____ Other identifying information (optional) _____

Demographics of class. Please give number of students for each characteristic.

_____ Female ____Asian ____Black ____Hispanic ____Native American/Canadian

_____ Male ____White ____Other (please specify) _____

Estimate of overall SES (check one)

____Lower ____Upper middle

____Lower middle ____Upper

____ Middle

Ability Level & Grouping

___Below Average ___Homogeneous

___Average ___Heterogeneous

___Above Average

Secondary Project General Mathematics Series

C

Teacher Information

Below are a series of statements about teaching general mathematics, using supplementary materials, etc. Please be as candid as possible.

Please circle the degree to which you agree or disagree with the following statements. The alternatives are as follows:

SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree

1. Most general mathematics students are fairly eager to learn.	SA	A	U	D	SD
2. General math teachers are particularly well prepared for teaching computational skills.	SA	A	U	D	SD
3. Motivating students to see mathematics in a new way would be a primary motive for my selecting television materials for classroom use.	SA	A	U	D	SD
4. I have almost no supplementary materials for teaching general mathematics.	SA	A	U	D	SD
5. Few students have the entry level skills required by general math textbooks and materials.	SA	A	U	D	SD
6. Real life applications are the easiest part of teaching general math.	SA	A	U	D	SD
7. Audio-visual materials should treat the same material as is in the course textbook.	SA	A	U	D	SD
8. Too many general math instructors were trained in another curriculum area.	SA	A	U	D	SD
9. A primary reason for selecting television programs for in-class use would be to repeat skills and computations on which the class must be tested.	SA	A	U	D	SD
10. Most general math students are as intellectually capable as those who enroll in algebra.	SA	A	U	D	SD

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Please turn over

11.	Attitude change is often a crucial ingredient for success in general math classes.	SA	A	U	D	SD
12.	Teaching probability and statistical calculations is difficult.	SA	A	U	D	SD
13.	Audio-visual materials should add new ideas to the curriculum beyond what is in a course textbook.	SA	A	U	D	SD
14.	General math instructors would like supplementary materials which present applications of mathematical processes (like measuring, predicting, etc.) to real life situations.	SA	A	U	D	SD
15.	General math instructors are well prepared academicallly for teaching the course.	SA	A	U	D	SD
16.	Drill and practice on mathematical competancies should be the major focus of a general math curriculum.	SA	A	U	D	SD
17.	Demonstrating the value of mathematics in every day situations motivates students to learn.	SA	A	U	D	SD
18.	Most general math students under-estimate their knowledge and competancies.	SA	A	U	D	SD
19.	Even if ITV programs were available, lack of equipment would preclude use.	SA	A	U	D	SD

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D

General Math Questionnaire

This exercise asks how you feel about mathematics or mathematics activities. There are no right or wrong answers.

Please show how much you agree or disagree with each statement by circling one response.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Mathematics is useful in solving everyday problems.	SA	A	U	D	SD
Exploring number patterns plays almost no part in mathematics.	SA	A	U	D	SD
Mathematics is a subject I enjoy.	SA	A	U	D	SD
I can't understand how some students think math is boring.	SA	A	U	D	SD
I am willing to work hard to do well in mathematics.	SA	A	U	D	SD
Mathematics is more for girls than boys.	SA	A	U	D	SD
Learning mathematics is mostly memorizing.	SA	A	U	D	SD
Math is interesting to me.	SA	A	U	D	SD
There is always a rule to follow in solving mathematics problems.	SA	A	U	D	SD
Most of mathematics has practical use.	SA	A	U	D	SD
Knowing how to solve a problem is as important as getting the solution.	SA	A	U	D	SD
Doing mathematics requires lots of practice in following rules.	SA	A	U	D	SD
I can get along well in everyday life without using mathematics.	SA	A	U	D	SD
I enjoy math class more than most other classes.	SA	A	U	D	SD
Fewer men than women have the logical ability to become mathematicians.	SA	A	U	D	SD

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	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Mathematics is made up of related skills.	SA	A	U	D	SD
Knowing why an answer is correct is as important as getting the correct answer.	SA	A	U	D	SD
Mathematics is related to other subjects in school.	SA	A	U	D	SD
I am uncomfortable in math class.	SA	A	U	D	SD
I really want to do well in mathematics.	SA	A	U	D	SD
My parents really want me to do well in mathematics.	SA	A	U	D	SD
I feel good when I solve a mathematics problem by myself.	SA	A	U	D	SD
No matter how hard I try, I cannot understand mathematics.	SA	A	U	D	SD
It is important to know arithmetic in order to get a good job.	SA	A	U	D	SD
I am taking mathematics only because I have to.	SA	A	U	D	SD
I don't like to ask a question in math class.	SA	A	U	D	SD
I am good at mathematics.	SA	A	U	D	SD
Mathematics helps a person to think logically.	SA	A	U	D	SD
Knowing mathematics helps me become a better problem solver.	SA	A	U	D	SD
There is so much hard work in mathematics that it takes the fun out of it.	SA	A	U	D	SD
Mathematics is more for boys than for girls.	SA	A	U	D	SD
I would like to take more mathematics.	SA	A	U	D	SD
Creative people usually have trouble with mathematics.	SA	A	U	D	SD
Mathematics is not really very practical.	SA	A	U	D	SD

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	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
I like math books better than other textbooks.	SA	A	U	D	SD
Estimating is an important mathematical skill.	SA	A	U	D	SD
I usually understand what we are talking about in mathematics.	SA	A	U	D	SD
Trial and error can often be used to solve a mathematics problem.	SA	A	U	D	SD
Math is not as important as other subjects.	SA	A	U	D	SD
Doing math problems makes me nervous.	SA	A	U	D	SD
Mathematics is boring for me.	SA	A	U	D	SD
Mathematics is a subject that is more difficult to understand than other subjects.	SA	A	U	D	SD
A good grade in mathematics is important to me.	SA	A	U	D	SD
Being able to say why you do things is an important part of mathematics.	SA	A	U	D	SD
I like doing math problems more than writing reports.	SA	A	U	D	SD
I would like to work at a job that lets me use mathematics.	SA	A	U	D	SD
I am good at working with numbers.	SA	A	U	D	SD
Mathematics is too concerned with ideas to be really useful.	SA	A	U	D	SD
Most people do not use mathematics in their jobs.	SA	A	U	D	SD
People who solve mathematical puzzles are clever.	SA	A	U	D	SD
The more math courses you take the better job you can get.	SA	A	U	D	SD

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Secondary Project General Mathematics Series **E**

Student Information

Below are math activities which might or might not be applied to everyday life. Think about each activity and decide how often you might use it outside of school, in a job, a hobby, or other things you might do.

If you don't understand what the phrase means, put a check on the line at the left. Circle any words in the phrase you don't know.

How often would you...	Very often	Often	Undecided	Not very often	Not often at all
____ get information about a small group in order to guess about the whole group	( )	( )	( )	( )	( )
____ estimate answers to problems	( )	( )	( )	( )	( )
____ find volumes	( )	( )	( )	( )	( )
____ make a table of numbers	( )	( )	( )	( )	( )
____ memorize rules and formulas	( )	( )	( )	( )	( )
____ make a scale model	( )	( )	( )	( )	( )
____ estimate measurements (lengths, widths, or areas, etc.)	( )	( )	( )	( )	( )
____ check an answer to a problem by going back over it	( )	( )	( )	( )	( )
____ describe a relationship by using a ratio	( )	( )	( )	( )	( )
____ change measures to the same unit in order to compare them	( )	( )	( )	( )	( )
____ look at a table of numbers for a pattern	( )	( )	( )	( )	( )
____ follow a map	( )	( )	( )	( )	( )

Please turn over

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	Very often	Often	Undecided	Not very often	Not often at all
___ make a diagram	( )	( )	( )	( )	( )
___ figuring the odds on whether or not something will happen	( )	( )	( )	( )	( )
___ work with fractions	( )	( )	( )	( )	( )
___ work with measures (lengths, weights, or temperature)	( )	( )	( )	( )	( )
___ find the average of a set of numbers	( )	( )	( )	( )	( )
___ work with percentages	( )	( )	( )	( )	( )
___ use charts and graphs	( )	( )	( )	( )	( )
___ work with decimals	( )	( )	( )	( )	( )
___ find areas	( )	( )	( )	( )	( )
___ use formulas to solve measurement problems	( )	( )	( )	( )	( )
___ write a ratio as a decimal or percent	( )	( )	( )	( )	( )
___ use proportions to find an unknown, desired number	( )	( )	( )	( )	( )
___ look up something in a table of numbers	( )	( )	( )	( )	( )
___ make a map	( )	( )	( )	( )	( )
___ follow a diagram	( )	( )	( )	( )	( )
___ use numbers to convince people	( )	( )	( )	( )	( )

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